Compressed Air Magazine

JULY 1956

PHOTO, CANADIAN GOVERNMENT TRAVEL BUREAU

CANADA DISPLAYS RUGGED GRANDEUR

Mount Edith Cavell as seen from highway in Jasper National Park

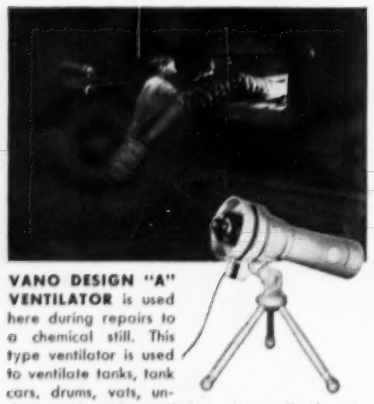
(SEE INDEX PAGE)

VOLUME 61 • NUMBER 7 NEW YORK • LONDON

COPPUS "BLUE RIBBON" VENTILATORS

Used in wide variety of applications throughout industry

Improve workers' safety . . . health . . . comfort . . . efficiency



VANO DESIGN "A" VENTILATOR is used here during repairs to a chemical still. This type ventilator is used to ventilate tanks, tank cars, drums, vats, underground cable manholes, pipe galleries, airplane wing compartments, fuselages and other confined places. Uses 8" diameter flexible canvas tubing ("Ventube").

VANO DESIGN "B" VENTILATOR here discharges welding fumes from double-bottom compartment in naval vessel under construction. Large volume of air handled quickly expels fumes and results in good ventilation. Vano Design "B" can pass through opening only 14" in diameter. Uses 8" diameter flexible canvas tubing ("Ventube").

VANO DESIGN "C" VENTILATOR here withdraws fumes from a reactor kettle. This ventilator can be furnished with 8" suction inlet for 8" non-collapsible suction tubing — or multiple inlet nozzles for 5", 4", and 3" suction hose. The discharge may be connected to 8" "Ventube." Capacities furnished on request.

NO. 2 AEROPLANE HEAT KILLER here directs cool, fresh air on worker in drop forge plant. Heat killers restore workers' efficiency by providing extra ventilation in the hot months, or on any job where workers are continually or periodically required to work in excessive heat. Available in two types, three sizes in each.

VENTAIR DESIGN TE-4 VENTILATOR Gasoline Engine Driven, here delivers air into underground manhole. These ventilators provide fresh air to men in confined places, promoting safety, comfort, and increasing efficiency. Ideal where no electric current is available. Delivers 1700 CFM of fresh air. Uses 8" diameter flexible canvas tubing ("Ventube").

PORTAIR NO. 4 BLOWER EXHAUSTER exhausts fumes resulting from soldering, welding, tank coating, is also used in ventilating small tanks. It is designed to permit attachment of 4" flexible metal hose. Capacity: 425 CFM free air.

ATTACH THIS COUPON TO YOUR COMPANY LETTERHEAD

COPPUS ENGINEERING CORPORATION, 207 PARK AVENUE, WORCESTER 2, MASS. Sales offices in Thomas' Register. Other "Blue Ribbon" Products in Chemical Engineering Catalog, Refinery Catalog, Best's Safety Directory and Mining Catalogs.

Please send me information on supplying fresh air to men working:

- ☐ in tanks, tank cars, drums, etc.
- ☐ in underground cable manholes
- ☐ in aeroplane fusilages, wings, etc.
- ☐ on coke ovens
- ☐ on steam-heated rubber processes
- ☐ on boiler repair jobs

COOLING:

- ☐ motors, generators, switchboards
- ☐ wires and sheets
- ☐ general man cooling
- ☐ around cracking stills
- ☐ exhausting welding fumes
- ☐ stirring up stagnant air wherever men are working or material is drying
- ☐ drying of walls, sheets, etc., after treated with coating material

Name .....

Company .....

Address .....

City .....Zone....State.....

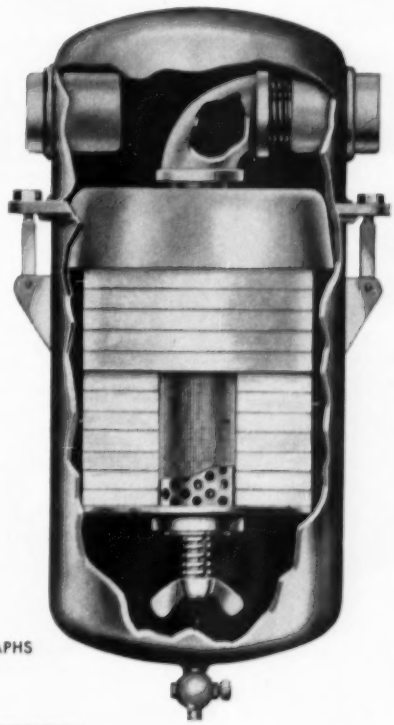
Write here any special ventilating problem you may have {

Circle 1A on reply card

MOISTURE FROM RUINING YOUR AIR-OPERATED EQUIPMENT

GET STAYNEW ABSORPTION FILTERS

Moisture, oil, and foreign matter can raise havoc in your compressed air lines. That's why Staynew Absorption Filters were designed. Thousands of manufacturers from coast to coast have eliminated process shutdowns and are now saving thousands of dollars annually since installing Staynew Absorption Filters. If you have air-operated equipment or processes you owe it to yourself to get all the facts on Staynew Absorption Filters.



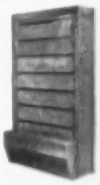
Model AAPHS

INTAKE FILTERS

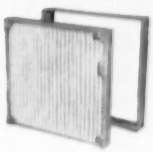
LIQUID FILTERS

PIPE LINE FILTERS

ELECTRO-STAYNEW PRECIPITATOR



AUTOMATIC AIR FILTERS



PANEL FILTERS

SPECIAL FILTERS

DOLLINGER PROTECTO-MOTOR STAYNEW FILTERS

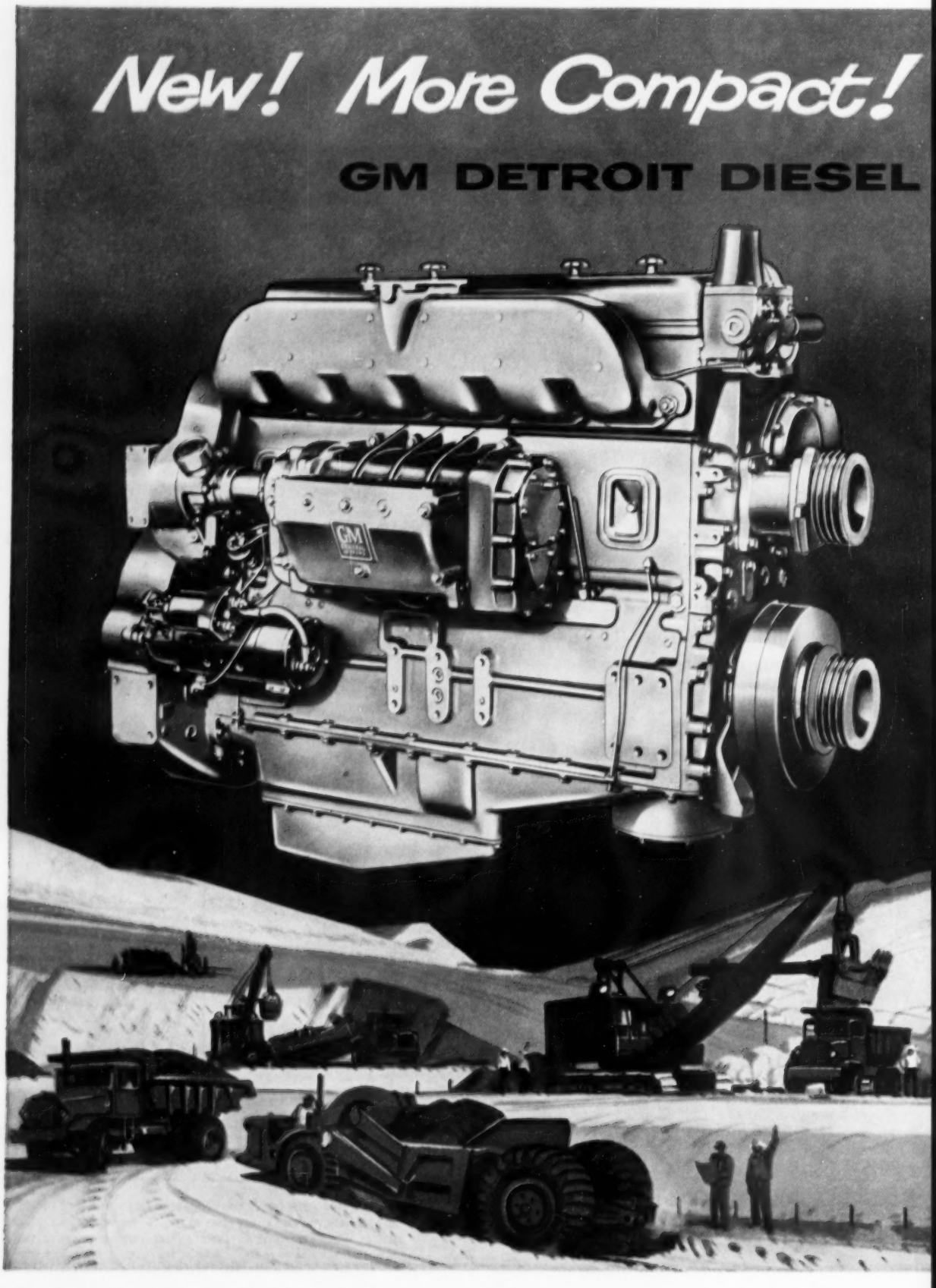
DOLLINGER CORPORATION

ALL TYPES OF FILTERS FOR EVERY INDUSTRIAL NEED

Write for Bulletin 200. Tell us about your special filtration problems. We'll be glad to help. Dollinger Corporation, Dept. 7, Centre Park, Rochester 3, N.Y.

LIQUID FILTERS • PIPE LINE FILTERS • INTAKE FILTERS • HYDRAULIC FILTERS
ELECTROSTATIC FILTERS • DRY PANEL FILTERS • SPECIAL DESIGN FILTERS
VISCOUS PANEL FILTERS • LOW PRESSURE FILTERS • HIGH PRESSURE FILTERS
AUTOMATIC VENTILATION FILTERS • NATURAL GAS FILTERS • SILENCER FILTERS

Circle 2A on reply card


New! More Compact!
GM DETROIT DIESEL

More Versatile!

300-H.P. SERIES 110 ENGINE

Now available to fit a broader range of power equipment

Now the best 300-horsepower Diesel is even better than ever—ready to step up production and cut costs on any job you name.

It's the time-proved General Motors Series 110 Diesel, newly equipped with a side-mounted blower similar to the one used on the famous 71 Series. It's a more compact engine. It's shorter. It's lower. It fits more applications than ever before.

You can have this new GM Detroit Diesel Series 110 engine installed in off-highway trucks and move bigger loads faster.

You can use it to increase the power of heavy crawler tractors, scrapers and air compressors—get more work per day and per dollar.

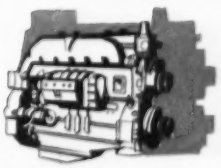
And, in practically no time at all, you can have this new Series 110 Diesel installed in almost any 3-yard shovel—to move earth faster at less cost.

The new blower makes the Series 110 engine far more versatile—available with *either* right- or left-hand rotation, and a wider range of accessory drive outlets—*four* accessory drives on the rear of the engine, and *four* fan-mounting positions on the front.

This new Detroit Diesel Series 110 engine takes on all comers in operating efficiency. It's a leader in work output per dollar. Let your local GM Detroit Diesel Distributor or Dealer show you what we mean.

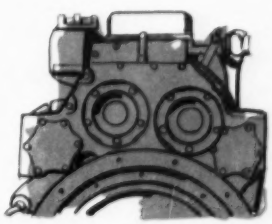
New Compactness—

The side-mounted blower eliminates former style blower at the end of the Series 110 engine and also cuts down height. Easier to install—easier to maintain.



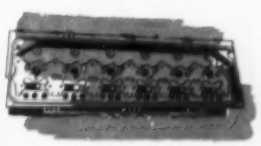
New Flexibility—

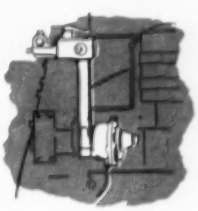
Four accessory drive outlets on rear of engine. You can direct drive both a hydraulic pump and an air compressor off the engine at the same time. New gear train features wider gears with increased helix angle for longer life. Blower and camshaft loads are split.



New long-life Cylinder Head

Has many design improvements, including integral water manifold and drilled passages for rocker-arm lubrication. Water manifold studs and gaskets eliminated. Outside rail gives extra rigidity.





New Governor

Is more easily serviced—utilizes many Series 71 parts. Provides for tachometer drive. An accessory drive may also be taken off the governor drive gear.

DETROIT DIESEL

Engine Division of General Motors, Detroit 28, Michigan

Single Engines . . . 30 to 300 H.P. Multiple Units . . . Up to 893 H.P.

In Canada: GENERAL MOTORS DIESEL LIMITED, London, Ontario

AMERICA'S LARGEST BUILDER OF DIESEL ENGINES

how to get the most out of HOLLOW DRILL RODS

The present trend in mining is toward smaller drill holes which require the use of smaller bits and, consequently, smaller hollow drill rod sizes. And that's increased the use of *alloy* steels such as Crucible CA DOUBLE DIAMOND and 4E Hollow Drill Rods.

These new alloy rods have proved themselves on many jobs by lengthening rod life, cutting drilling costs. But they are not unmixed blessings, for they will give a good account of themselves only if they are handled properly. Hammer and tongs blacksmithing isn't enough. Alloy rods demand greater care in forging, upsetting and heat-treating.

Should You Use Carbon or Alloy Rods?

There's no one answer to that question, unless it is *use the rod that best fits the individual job.* Generally, air-feed jackhammers and other small, light drills benefit from the use of alloy drill rods. For alloy rods have greater resistance to fatigue, higher elastic limits – important where smaller rod sizes are used.

Rod Stiffness . . .

Rigidity or stiffness can only be increased by enlarging the cross section of the rod. If you decrease the cross section you'll get more whipping no matter what type steel you use, or how you heat treat it. Therefore, don't use a ⅞" hexagon alloy rod when you've been using a 1¼" round carbon rod, unless an increase in flexing and less stiffness is unimportant.

Abrasion Resistance . . .

The higher the hardness the better a drill rod will stand abrasive wear. Alloy rods have the advantage in this respect, for they can be heat-treated to higher hardnesses than can carbon rods.

Notch Effect . . .

Notch effects caused by failure to overlap heats in treating shanks, or those caused by careless handling, chain marks or corrosion pits all cause rod failure. Alloy rods are more resistant to these nicks or notches than carbon steels, but when they do occur failure can be more rapid.

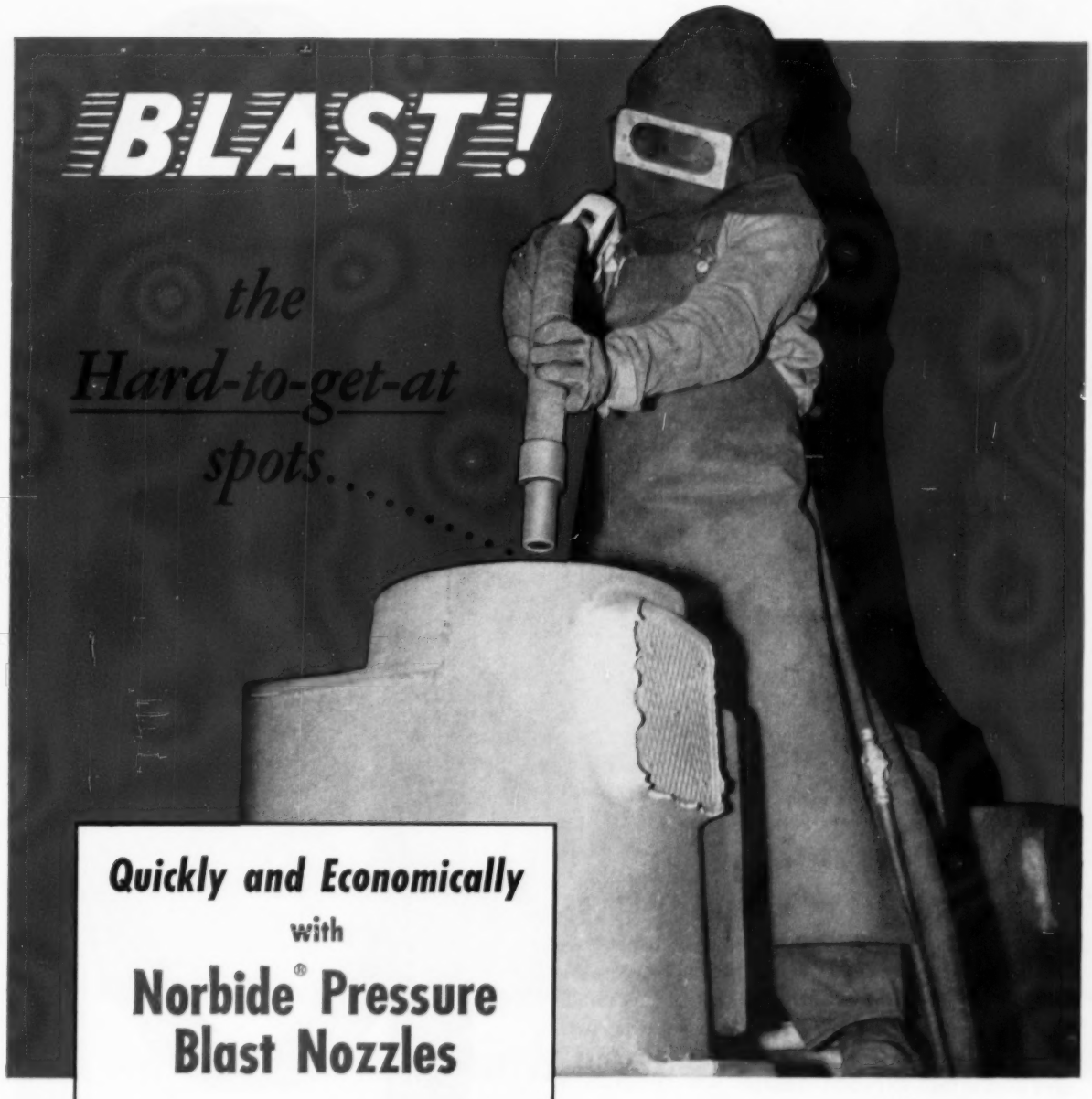
The answer to better drilling is simply this: choose the right drill rod, and then give it reasonable and proper care.

And for the *right* carbon or alloy hollow drill rods – in the sizes, shapes, and grades you need – Crucible is the place to go. *Crucible Steel Company of America, The Oliver Building, Mellon Square, Pittsburgh 22, Pa.*

CRUCIBLE first name in special purpose steels

Crucible Steel Company of America

Circle 3A on reply card



Quickly and Economically with Norbide® Pressure Blast Nozzles

You'll find there's a NORBIDE Nozzle available to give you exactly the type of cleaning stream you need — from a pencil-thin stream for cleaning hard-to-get-at spots to a broad stream for large areas. And NORBIDE Nozzles - lined with the hardest manufactured material commercially available — maintain stream contour, last longer than any other nozzle made and deliver maximum blasting efficiency at minimum cost per hour.

NORTON COMPANY,
41 New Bond St., Worcester 6, Mass.

NORTON®
BORON CARBIDE

NORTON COMPANY, Publicity Dept.
41 New Bond Street, Worcester 6, Mass.

Please send me full details on NORBIDE Nozzles.

Name .....

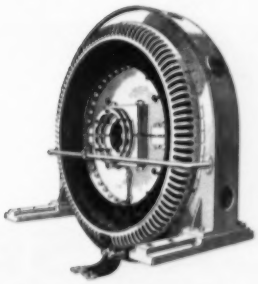
Company .....

Street .....

City ..... Zone ..... State .....

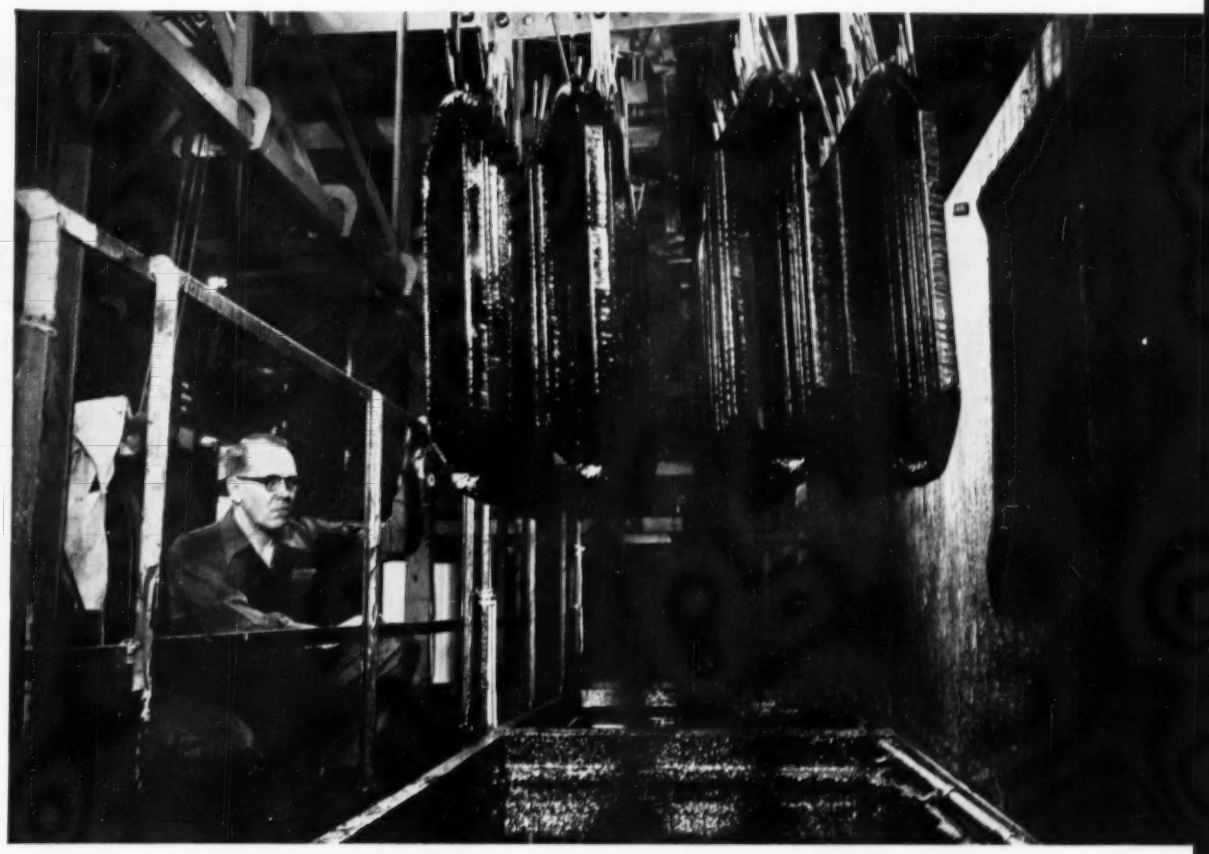
NORBIDE®. . . *The Longest Nozzle Life You Can Buy*

Circle 4A on reply card



HOW G-E SYNCHRONOUS MOTORS

REDUCE MAINTENANCE COSTS



An insulating bath helps fight moisture

Moisture has the unhappy habit of working its way through motor coil insulation and reducing its capacity to withstand voltage stress. To guard against exasperating production-line shutdowns, General Electric seals coils with a coating of high-grade insulating resins. This seal is applied by a conveyor belt dip and bake system.

It works like this. After the main body of insulation is applied in the form of tapes and films of non-hygroscopic materials, each set of coils is placed on a conveyor and dipped in a bath of special, synthetic insulating materials. This way the coating is uniformly applied. Then the conveyor carries the coils into a huge oven and cures them for a specific length of time. The cycle is repeated until the proper seal is built up. Each step is automatically and precisely controlled—length of dipping and baking time and temperature.

This means the coils on your G-E synchronous motor are protected by a hard, tough insulation with high dielectric strength and high resistance to moisture and contaminants. Its glossy surface makes the coils easy to clean too.

All this adds up to less maintenance and down-time. For more information on G-E synchronous motors, contact your nearest General Electric Apparatus Sales Office or write Section 775-4 for Bulletin GEA-5332. General Electric Company, Schenectady 5, N. Y.

GENERAL ELECTRIC

KOPPERS SEALING RINGS REDESIGNED to give the most efficient sealing available!

Reduce Leakage to a Minimum!

Fewer Rings Required!

Redesigned Koppers Sealing Rings provide *tighter,* better sealing for your hydraulic, pneumatic and other applications . . . under a variety of operating conditions. And, you need *fewer* rings because Koppers Sealing Rings are redesigned to give the *tightest* seal.

Koppers *redesigned* Sealing Rings can be used for static sealing, for sealing rotating and reciprocating motion . . . under high temperatures, corrosive conditions, poor lubrication and where high-strength materials are required. Koppers Sealing Rings are available in grey iron, in high-strength ferrous and non-ferrous alloys.

A wide range of standard Koppers Sealing Rings is immediately available. However, if you have a new application, our engineers will *custom-design* a ring to fit your individual needs. They'll produce a ring that gives you top performance under your particular operating conditions. For more detailed information, write to: KOPPERS COMPANY, INC., Piston Ring and Seal Dept., 1607 Scott Street, Baltimore 3, Maryland.

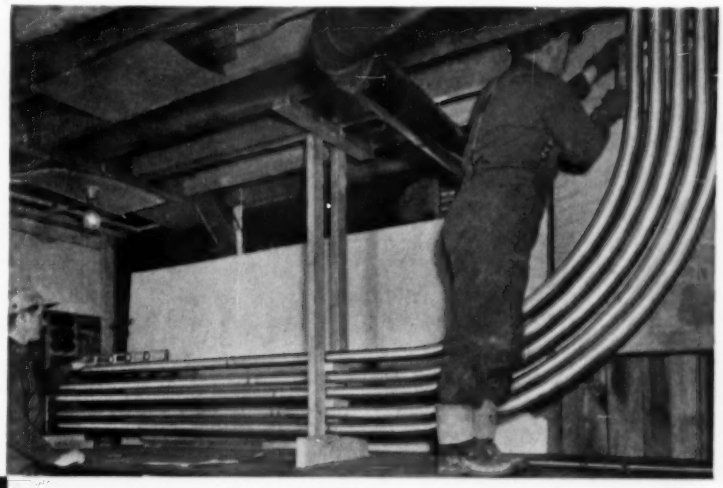
KOPPERS®

SEALING RINGS

Koppers Company, Inc.,
Metal Products Division
Piston Ring And Seal Dept.

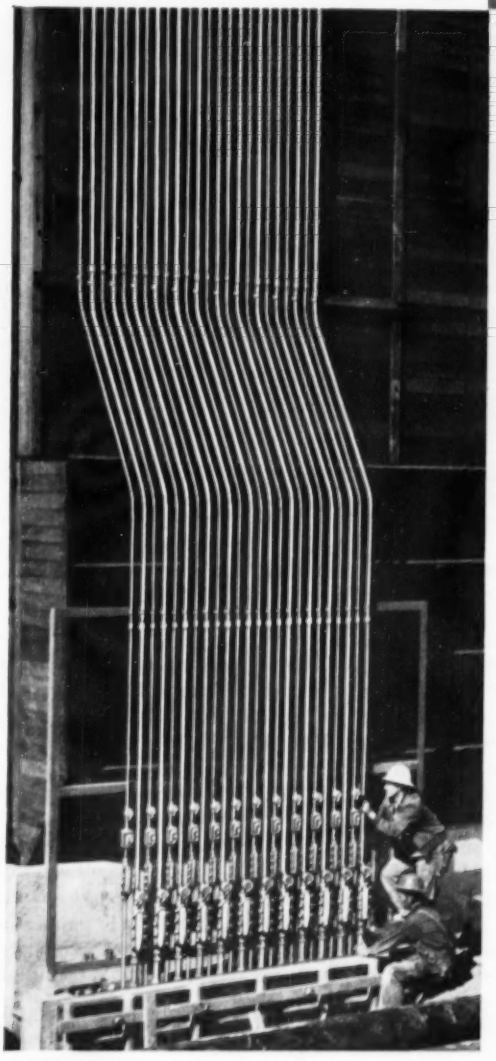
Engineered* Products Sold With *Service

DOWN a humid 180 feet below water level at Downsville Dam



Some 3600 feet of 2" Everdur Conduit (E.M.T.) protect electric lines in a service shaft plunging down to the release water chamber 180 feet below water level at Downsville Dam of the New York Metropolitan Water Supply System. Electric lines operate vital valves, indicating and communication equipment.

UP in the corrosive air at a water cooling tower



During the War, General Petroleum Corp. saw galvanized conduit fail within a year at one of its plants—replaced it with Everdur Conduit. At its new Ferndale Mobilgas Refinery in Washington, some 12,000 pounds of Everdur Conduit in various sizes guard electric power lines for motors and lighting in this water cooling tower.

EVERDUR Conduit will guard the electric power lines—for years

Everdur* Never Rusts. It offers high resistance to other types of corrosion. That's why Everdur Conduit—made from one of Anaconda's exclusive copper-silicon alloys—is specified for dependable year-after-year protection of electric power lines in industry, on bridges, at power and water supply projects—wherever water and corrosive atmospheres are a problem—or where conduit must be buried or embedded in concrete.

Everdur is Tough. In addition to corrosion resistance, Everdur has high physical strength, resists wear and abrasion. It stands up under movement and vibration, as on a bridge, in a subway, in a factory.

Everdur is Nonmagnetic. Everdur Conduit creates no magnetic field to produce temperature rise in electric power cables.

Everdur Electrical Conduit is available in two wall thicknesses —R.C. in nominal sizes from ¼" to 4", inclusive, and E.M.T. in nominal sizes ⅜" to 2", inclusive. For more detailed information write: The American Brass Company, Buffalo Division, Buffalo 5, N. Y. In Canada: Anaconda American Brass Ltd., New Toronto, Ontario.

55120A

*Reg. U. S. Pat. Off.

EVERDUR ELECTRICAL CONDUIT

ANACONDA®

COPPER SILICON ALLOYS

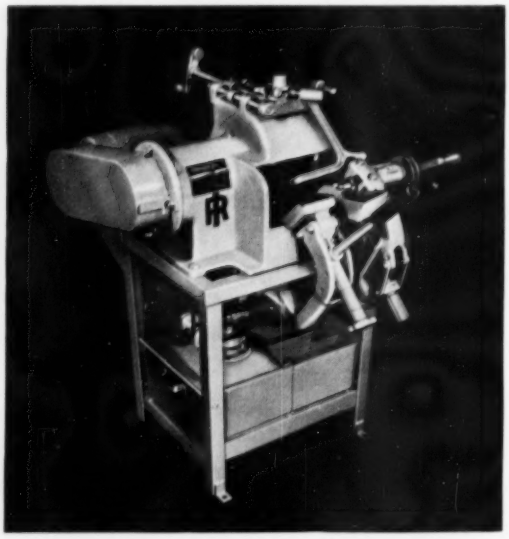
CORROSION RESISTANT • STRONG • NONMAGNETIC • WORKABLE • WELDABLE

CARSET JACKBITS

LAST LONGER, DRILL FASTER THAN EVER

...when you keep them sharpened, with machine precision, on the new

JC-3 JACKBIT GRINDER



A NEW Ingersoll-Rand Carset Jackbit has no equal for sustained high drilling speed and maximum bit life in practically any type of rock.

To maintain this "good as new" performance after resharpening, it's important that the cutting faces be ground without unnecessary waste and to the proper shape. Although hand grinding can be used successfully where the number of bits sharpened per day is limited, higher production calls for a *faster* and *more precise* method of resharpening.

These requirements are met to excellent advantage with the new JC-3 Jackbit Grinder. All bit surfaces are ground with machine precision to exactly the right shape for maximum drilling efficiency — more quickly, easily and accurately than can be done by hand grinding.

While the JC Grinder has many new and improved features, it has the same basic design that has proved itself in over 20 years of service. All bearing and wearing surfaces are protected against the entrance of abrasive grits, virtually eliminating bearing maintenance costs. The Jackbit Grinder can be purchased complete with cooling and gauging equipment and electric, air-motor or gasoline-engine drive — or it can be obtained with only that equipment needed for any particular job. To get the *most* out of your Carset Jackbits, ask your I-R representative for complete information on this time-saving, cost-saving Jackbit Grinder.

15-416

FREE WALL CHART: HOW TO GRIND CARSET JACKBITS

Ingersoll-Rand, Rock Drill Dept., 11 Broadway, New York 4

Please send me illustrated wall chart, Form 4121, showing step-by-step instructions for the proper resharpening of Carset Jackbits.

NAME_____

COMPANY_____

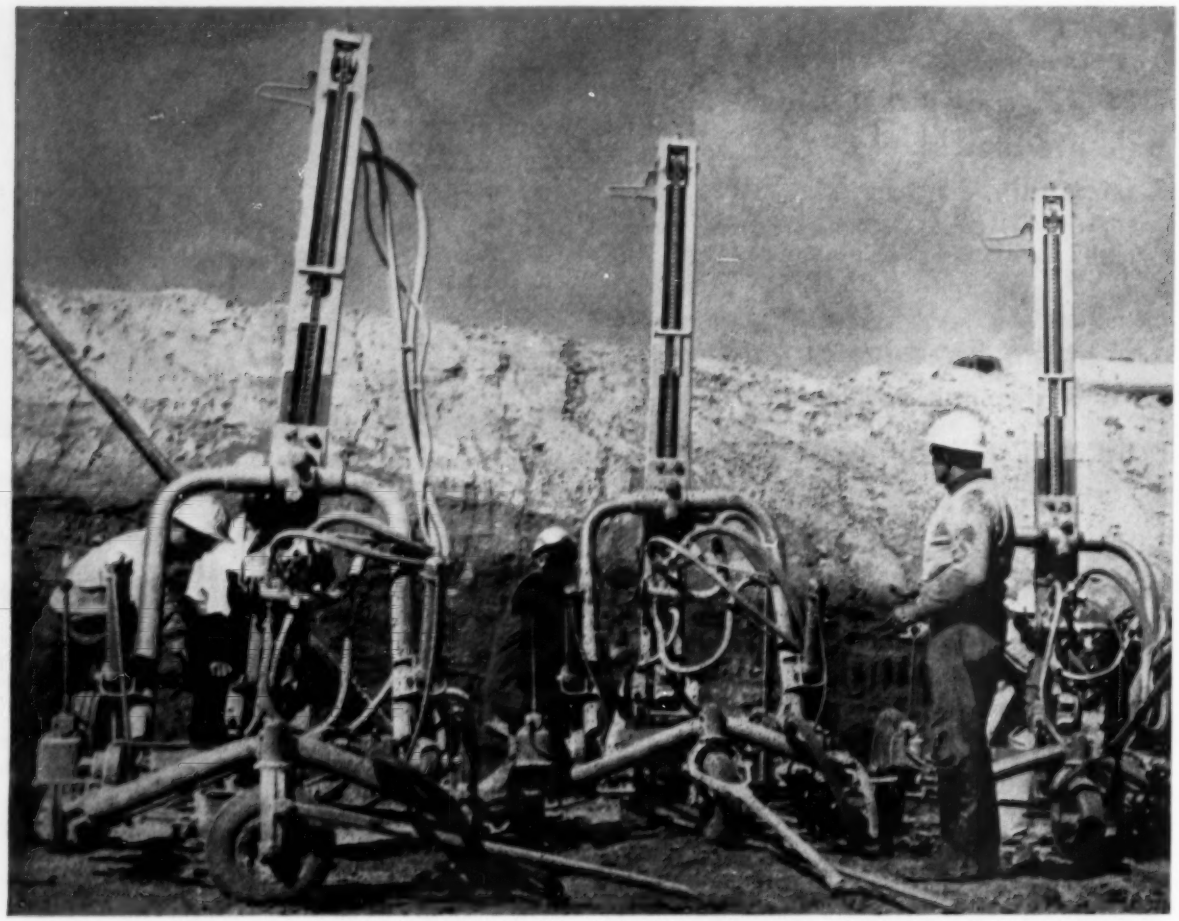
ADDRESS_____

CITY_____ STATE_____

Ingersoll-Rand

11 BROADWAY, NEW YORK 4, N. Y.

ROCK DRILLS • COMPRESSORS • AIR TOOLS • CENTRIFUGAL PUMPS • TURBO BLOWERS • CONDENSERS • DIESELS GAS ENGINES



Making blast holes with Bethlehem Hollow during early stages of construction for Long Sault Dam. Contractors are Walsh Construction Co. and B. Perini & Sons; Morrison-Knudsen Co.; Peter Kiewit & Sons; Utah Construction Co.

240,000 cu yd of Dolomite Being Moved for Long Sault Dam on St. Lawrence

What you see here is Bethlehem Hollow Drill Steel making blast holes in dolomite at the site selected for Long Sault Dam, near Massena, N. Y. The dam, part of the St. Lawrence River Power Project, is to be a curved concrete gravity-control structure, 2890-ft long. Including earth wing dams, its eventual length will be 7340 ft. Its 30 ogee spillway openings will be controlled by 50 ft x 28 ft vertical lift gates, flanked by concrete overflow sections and earth embankment to high ground at each end.

Bethlehem Hollow was used almost exclusively on this job, in ⅞-in. hexagons and 1¼-in. rounds, fitted with carbide-insert bits. Because of the rock condition, blast holes were limited to 5 ft. The drill steel performed economically, with minimum breakage.

Wherever there's rock to be moved, whether for a dam or highway, or in a mine, or some other application, you can count on good, steady performance from Bethlehem Hollow. That is because it is rolled from a special grade of steel which is resistant to fatigue. Bethlehem Hollow has a uniform hole, centrally located in the bar. It also has a wide quenching range, and is easy to heat-treat for the proper balance of toughness and wear-resistance, making possible long-wearing threads and strong shanks.

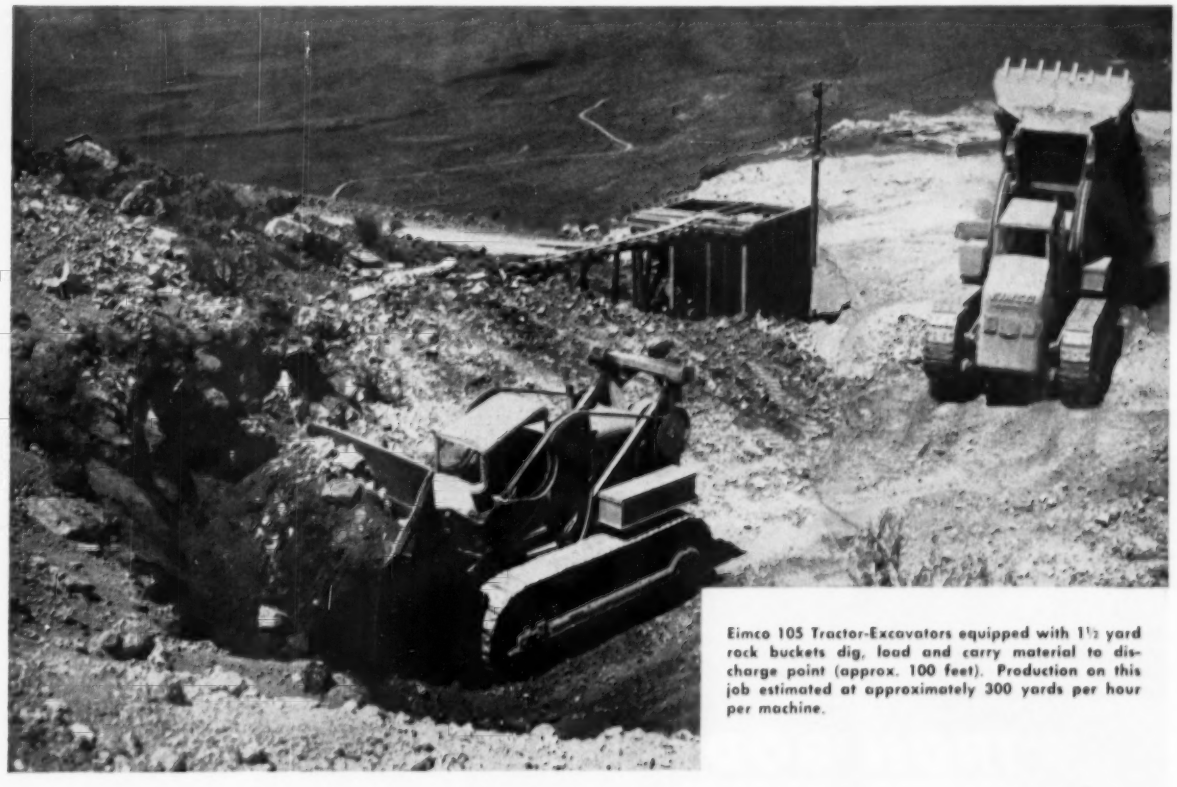
Bethlehem Hollow is made in carbon and ultra-alloy grades, in rounds, hexagons and quarter-octagons, generally in lengths of from 18 ft to 25 ft. It also comes in longer lengths to meet special needs. Keep Bethlehem Hollow in mind for your next rock-removal project.

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation. *Export Distributor:* Bethlehem Steel Export Corporation

BETHLEHEM HOLLOW DRILL STEEL CARBON AND ULTRA-ALLOY

BETHLEHEM STEEL



Eimco 105 Tractor-Excavators equipped with 1½ yard rock buckets dig, load and carry material to discharge point (approx. 100 feet). Production on this job estimated at approximately 300 yards per hour per machine.

SPEED, VERSATILITY AND DEPENDABILITY WITH EIMCO 105 TRACTOR-EXCAVATORS

Eimco 105 Tractor - Excavators, shown above, dig and load more rock at less cost per yard than any other earthmoving machine.

These Eimco Excavators are multi-purpose machines. They are easily and quickly moved from one spot to another where work is needed. They are used as prime movers, on production excavation and loading jobs, for bulldozing and other work around the plant.

In production work, the Eimco 105 Tractor-Excavator will load in rock at the rate of 5-6 yards per minute and in easier materials such as sand and gravel, the 105 will load as much as 8-9 yards per minute.

Eimco 105's do a better job than the conventional tractor mounted machine because of Eimco's exclusive operating features. Independent track operation increases the effectiveness of the machine in speed of maneuverability, saves travel time and wear and tear on track assemblies, chains and all crawler parts.

The Eimco power shift saves wear and tear on operators, keeps them fresh and alert all day long. Operator position up front makes it possible to see what is being done.

All cast-alloy steel parts are standard equipment on Eimcos at no extra cost. Torque converters, also standard, provide better engine operating flexibility and protect the engine from shock.

Eimco 105's are different in construction, design and operation. They are the only really modern tractors in production today. An Eimco engineer will be glad to tell you about the 105 and answer your questions. When you need a Tractor or Tractor-Excavator be sure to see an Eimco 105 at work, and talk to people using them. You are invited to compare the Eimco 105 Tractor, piece for piece with the tractor you are using or any other tractor.

THE EIMCO CORPORATION

Salt Lake City, Utah—U.S.A. • **Export Offices: Eimco Bldg., 52 South St., New York City**

New York, N. Y. Chicago, Ill. San Francisco, Calif. El Paso, Tex. Birmingham, Ala. Duluth, Minn. Kellogg, Ida. Baltimore, Md. Pittsburgh, Pa. Seattle, Wash. Pasadena, Calif. Houston, Texas Vancouver, B. C. London, England Gateshead, England Paris, France Milan, Italy Johannesburg, South Africa

EIMCO

B-207

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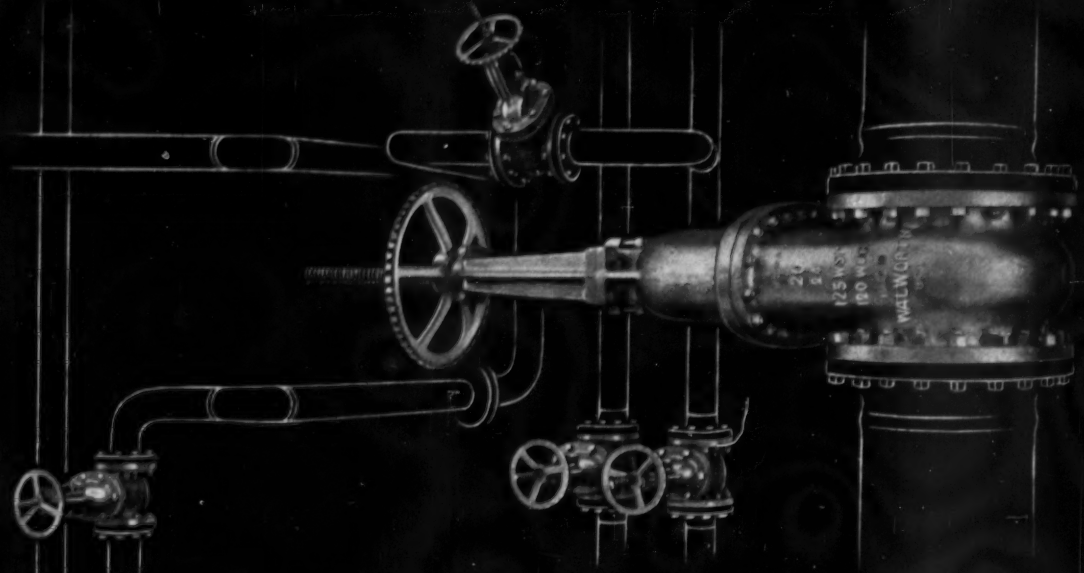
WALWORTH



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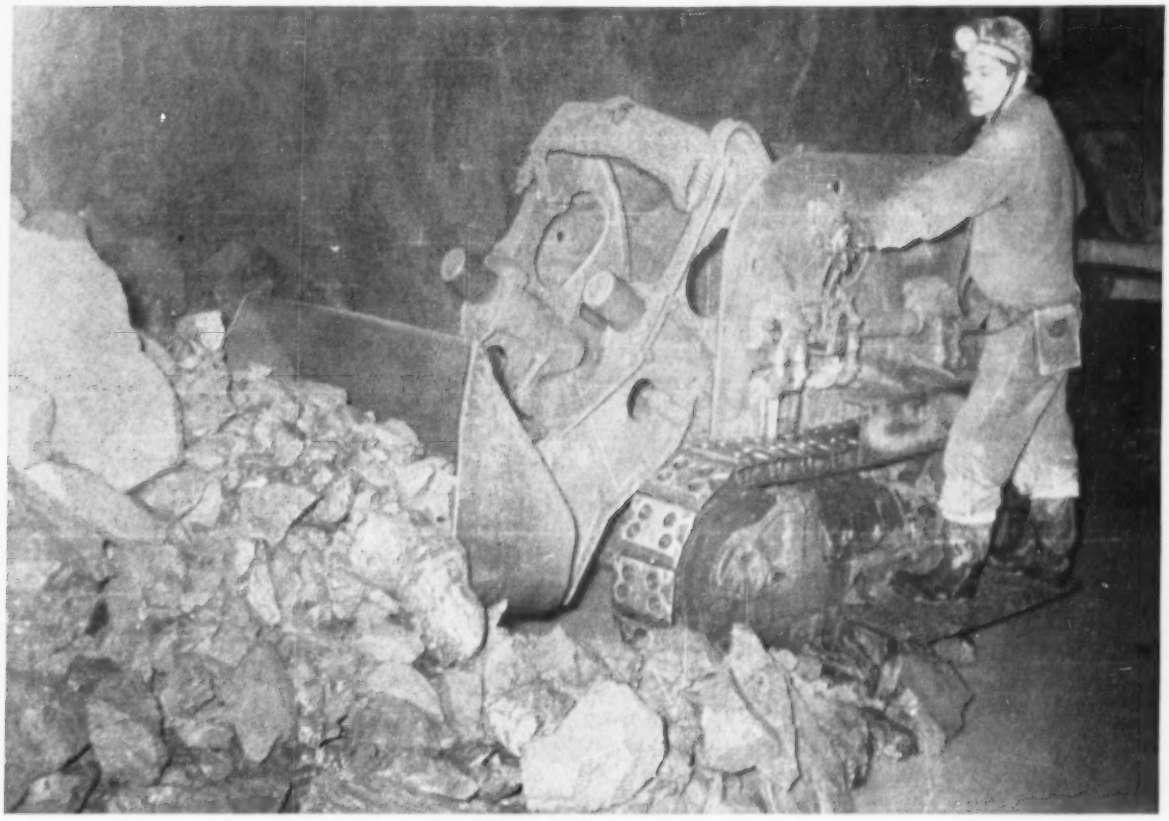

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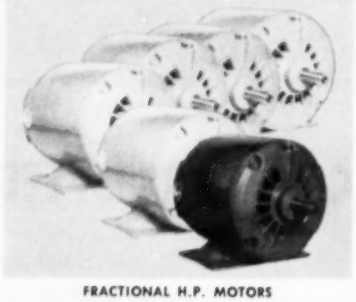

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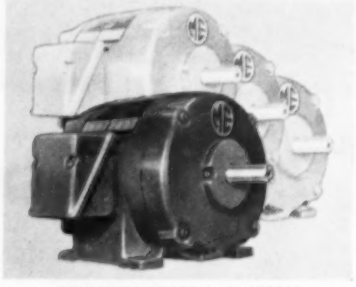

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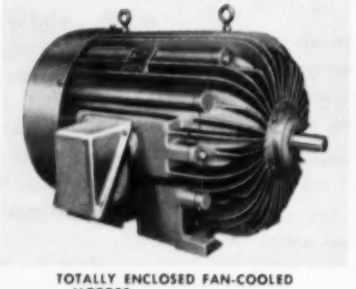

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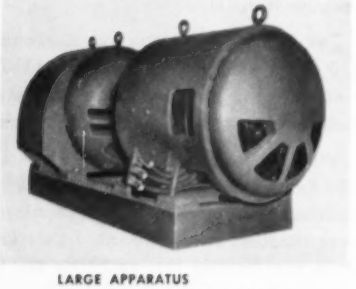

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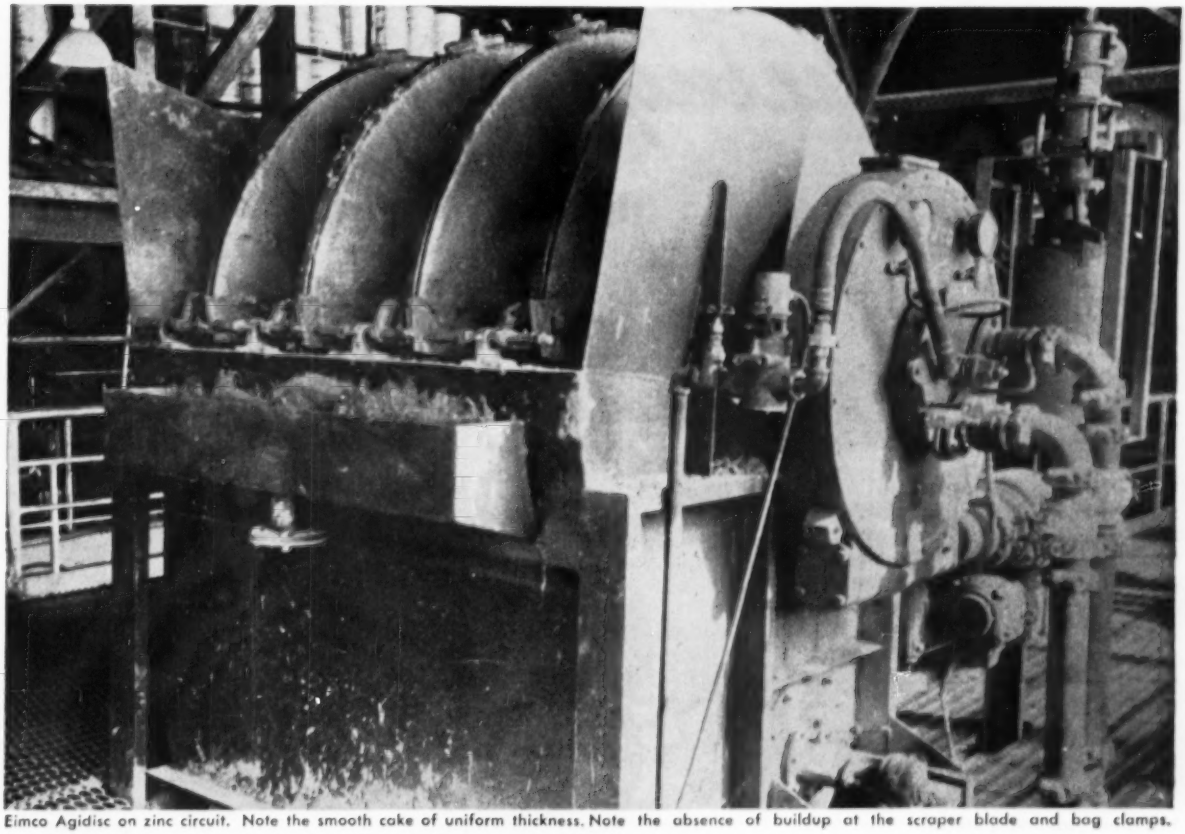
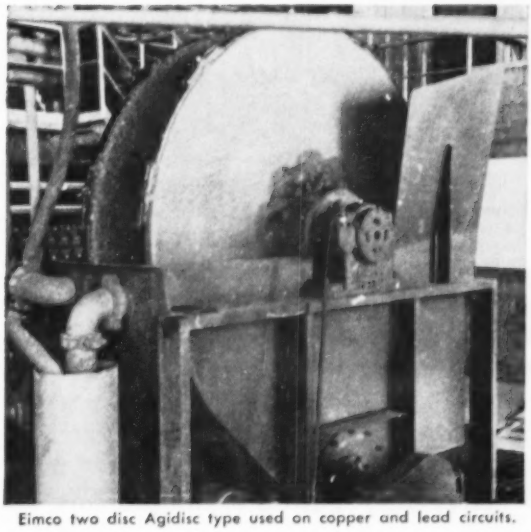


Eimco Agidisc on zinc circuit. Note the smooth cake of uniform thickness. Note the absence of buildup at the scraper blade and bag clamps.

LOW MOISTURE AT HIGH ALTITUDES WITH EIMCO AGIDISC FILTERS



Eimco two disc Agidisc type used on copper and lead circuits.

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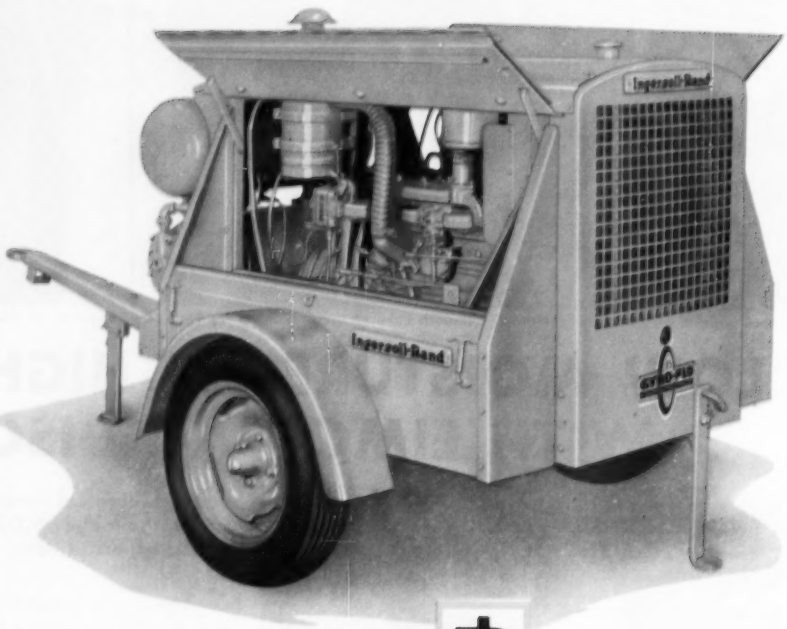

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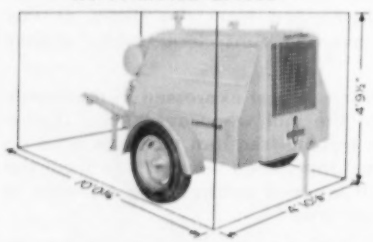

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ON THE COVER

OUR cover picture was selected on one of New Jersey's hottest and muggiest June days. It seemed a bit soothing and cooling to look at it then, and we figured it might have the same effect on those who chance to glimpse it on a torrid day in July. The scene is in one of Canada's beautiful national parks astride the Rockies. Before the summer ends, thousands of other tourists, perhaps even some who read this, will pause somewhere along the Banff-Jasper highway to take in an awe-inspiring vista, just as the people shown on our cover are doing.

IN THIS ISSUE

OF THE more than 90 million telephones in the world the United States has about 55 percent. We have more than 30 'phones for every 100 persons—almost ten times the world ratio. The Bell System is easily the largest in existence and the most highly developed. It leaves little to chance, even provides safeguards in the larger cities against rarely experienced power outages. Our leading article takes us behind the scenes—even under the streets—to learn something about the telephone service in New York City.

•

IN 1900, when gas and electricity were vying for supremacy in the lighting industry, a 100-watt lamp cost $1.43. If today's 100-watt units were made as they were at the turn of the century each would cost about $4. Applying some tricks of automation with the aid of compressed air has brought the price down to around 25 cents. Page 199.

•

ESSO Standard Oil Company's experiment in storing heating oil in an abandoned Pennsylvania slate quarry came through its first year successfully. Almost a million barrels was transferred into and out of the pit with only inconsequential loss. The favorable results would seem to presage additional facilities of the sort. Page 204.

Compressed Air Magazine

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EDITORIAL CONTENTS

Keeping Telephones on the Job—*R.J. Nemmers* . . . 192
Light by Sylvania—*G.B. Richardson and Robert James* . . . 199
Oil Stored in Old Quarry . . . 204
Bolting Combats Paper-mill Vibration . . . 206
Air-supported Buildings . . . 207
This and That . . . 208
Bridges of Two Centuries . . . 209
Downtown Cleveland Lights Up . . . 210
Editorials—Importance of Saving—Notable Anniversary . . . 211
A Door That Isn't a Door . . . 212
Process Produces Concrete of Variable Density . . . 212
Railway in the Sky . . . 213
Aluminum-Alloy Rivets Made for Hot Driving . . . 213
Vibration Unit to Study Shipping Damages . . . 214
Industrial Notes . . . 215
Briefs . . . 221
Books and Industrial Literature . . . 223

ADVERTISING CONTENTS

Adams Co., Inc. R.P. . . . 29
Air-Maze Corporation . . . 20
Anaconda Company, The . . . 11
Bethlehem Steel Company . . . 12
Continental Motors Corporation . . . 26
Cook Mfg. Co., C. Lee . . . 30
Coppus Engineering Corp. 2nd Cover
Crucible Steel Co. of America . . . 6
Detroit Diesel Div.-Gen. Motors 4, 5
Dixon Valve & Coupling Co. . . . 21
Dollinger Corporation . . . 3
Eimco Corporation, The . . . 13, 15, 17
Garlock Packing Company, The . . . 28
General Electric Company . . . 9
Ingersoll-Rand Company 10, 18, 22, 23, 3rd Cover
Koppers Company, Inc. . . . 8
Marathon Electric . . . 16
M-B Products . . . 29
Naylor Pipe Company . . . 25
New Jersey Meter Company . . . 30
Norton Co. . . . 7
Nugent & Co., Inc. Wm. W. . . . 24
Square D Company . . . 30
Texas Company . . . Back Cover
Victaulic Co. of America . . . 27
Walworth Company . . . 14
Wisconsin Motor Corporation . . . 19

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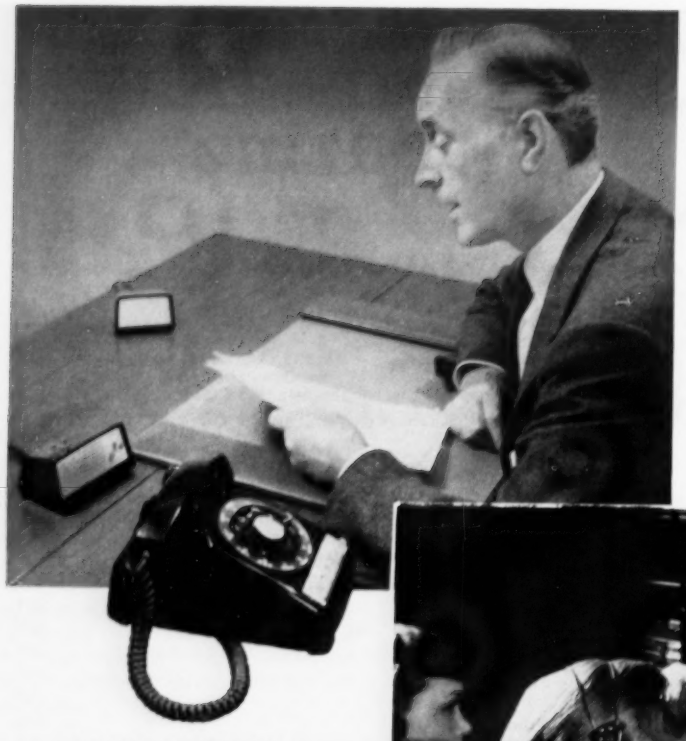


NO HANDS NEEDED

The Speakerphone above is a handy device for those who handle papers, take notes or look up information while talking. It is tied in with the regular phone and consists of a transmitter (center-left) and a speaker (lower-left). The user talks in a normal tone. He can control the volume of the speaker or shut it off if he wants to use the regular telephone set. The receiver of the latter doesn't have to be "off the hook" to use the Speakerphone.

KEEPING TELEPHONES ON THE JOB

Standby Diesel-engine Generators Help Prevent Service Failures in New York City

R. J. NEMMERS

IT SEEMS to be the trend of our age to make the world smaller with each passing year. High-speed travel is not the only shrinking force at work. Playing a big part in bringing the peoples of the globe closer together are improved means of communication, not the least of which is the modern telephone. Indeed, the linkage by which any two 'phones are interconnected is nothing short of a miracle because of the simplicity of its operation insofar as the user is concerned and because of the complexity of the actual functioning of the equipment behind the scenes.

According to statistics compiled by the American Telephone & Telegraph Company there are 94.5 million telephones in the world that can be connected to some type of public system. Of that total almost 91 million can be reached through the facilities of the Bell System, a group of companies united under AT&T. The 46,218,233 Bell System instruments in service in the United States at the close of 1955, together with those operated by nearly 5000 other concerns, give this country about 56 million

NIMBLE FINGERS AND A SMILING VOICE

Because about 87 percent of the Bell System 'phones are now of the dial or automatic type, most Americans hear the famed "voice with a smile" only when they contact "Information" or place a long-distance call. The long-distance operator pictured links the past with the present by using manually placed plugs as well as automatically switched circuits. Just above her right hand is the type of "dial" used by toll operators in many exchanges. Instead of turning a dial she pushes keys like those on an adding machine. Some subscribers are already able to put through their own long-distance calls without the aid of the operator.

—well over half of the telephones in the world.

It is, perhaps, only natural that the United States should be in the lead not only in the number of instruments but also in the art of telephony, because the telephone was developed and first put to use here. The story of its invention by Alexander Graham Bell is familiar to many of us; in fact, is one of the classics of our modern industrial age. The use of the 'phone has grown tremendously since 1878 when the first commercial exchange went into operation in New Haven, Conn., with 21 subscribers. Today, New Haven has about 125,000 subscribers, each of which can be put in vocal touch not only with the others but, as we have already said, also with 91 million telephones in other cities and countries, and thus actually with some three to five or more times that number of people—a fair percentage of the world's population.

The groundwork for the fabulous system of wires and cables which serves us today was laid early in the days of telephony. In 1915 New York City and San Francisco were joined; direct hookups with major Canadian cities came along soon after; by 1927 the first transatlantic connections were made via radio;* and in 1931 it became possible to converse across the Pacific Ocean.

A telephone system, although classed as a public utility, differs considerably from other utilities because of the very nature of its service. A gas or electric company must supply a dependable one-way flow of power or fuel to its customers. A telephone company is confronted with a similar problem, but it must also make arrangements by which any given subscriber's instrument can, at will, be connected to and disconnected from any other telephone in its or any connecting system. This explains the reason for the maze of wiring, for each single-party hookup and each multiparty line must be provided with a pair of circuits extending all the way to the exchange office. Electrical lines, on the other hand, need run only between the point of use and a main power circuit, which serves many other customers as well.

*The first transatlantic telephone cable is expected to go into operation this year.

BUSY PIT

New York City's Times Square district, where Broadway, Seventh Avenue and Forty-Second Street converge, has been called the crossroad of the world because of its concentration of both pedestrian and vehicular traffic. Not far away is another busy intersection—a meeting place of myriads of telephone lines. Shown is a cable splicer working in one of the four large manholes at that location. More conversations "ride the wires" here than at any other such meeting place in the world.

Each of the steps performed every time a call is made is simple in itself, but, added together, the cycle is complex. One way to describe what goes on behind the scenes is to explain the several functions in sequence. First let us examine a manually operated central exchange and some of the equipment installed in it so that we can draw a parallel between it and a dial or automatic exchange. Each single-party or line group of multiparty telephones is, as has been pointed out, directly connected to the exchange that serves it. Each of these circuits ends at what is known as a distributing frame from which exchange wiring, as differentiated from outside wiring, extends it to a switchboard run by operators—the famed "voices with smiles." At the switchboard the circuit terminates first in one kind of jack (a small hole or receptacle for a plug), directly above which is located a miniature lamp, and then in other jacks.

If you want to place a call you signal the operator of your intent simply by lifting the receiver from the hook. This closes a switch, thus lighting the little lamp connected to the first-mentioned jack. The particular operator who handles your outgoing calls, among others, then selects a pair of a series of plugs arranged in front of her and places one of them in the jack below the glowing lamp. She also moves a small switch associated with that pair of plugs, which establishes a connection between her headset and your instrument. Next, she asks for the number of the 'phone you wish to reach and inserts the other plug into the corresponding jack on the board. But before proceeding, she must check to see that the person you are calling is not using the telephone. She does this by touching the rim of the jack with the tip of the plug, and if the line is busy a signal sounds in her ear. If it is open, she pushes the plug all the way into the jack and operates a switch to ring the party. At the same time she disconnects herself from the circuit so that you may talk privately.

As soon as the girl at the switchboard has put the plug in the jack to answer you, its signal light goes out but another one flashes on. The latter is located close to the pair of plugs she chose for your call and stays on until the party answers the telephone. Then it goes out. When

OVERHEAD OR UNDERGROUND

The maze of overhead wires once found in our large cities has disappeared into cables that run underground or unobtrusively along suburban roadways. At the left is a bird's-eye view of a lineman installing a terminal box on an elevated cable. The wires contained in the short, coiled section of cable at his left terminate in a panel inside the box in front of him and will be spliced into the larger cable. Then individual lines will be run to homes from the box. The rope hanging from the lineman serves to haul up tools and equipment other than the assortment suspended from his belt. In the other picture is a cable splicer joining a maze of underground wires that isn't as confusing as it looks—color codes and special groupings direct his practiced fingers to the one sought. He wears a headset to communicate with workers at other ends of the cables so that each circuit can be "tested out" before a splice is made.

the conversation is ended and you hang up, the lamp flashes on again, a signal to the operator to remove both plugs from the board, thus clearing the way for you to place another call or for someone to communicate with you. It also frees the called party's line.

One of the anomalies of the telephone business is that as the value of each instrument was increased by putting it in touch with a steadily growing number of subscribers, charges for the varied services, particularly long-distance calls, were reduced. For example, a call between New York and San Francisco in 1920 came to $16.50; now a daytime conversation for a similar 3-minute period is billed at only $2.50, plus tax—nights and Sundays the rate is even lower. In the case of transoceanic hookups, a New York to London call in 1927, when that service was initiated, cost a subscriber $75. Currently, it may be made for only $9 nights and Sundays and for $12 during the day. Although long-distance rates provide the most striking example of price reduction, local calls, too, are less expensive. Not only can we communicate with many more people in nearly every instance, but many telephones that formerly could be reached only by toll calls have been brought into the non-charge or local-call bracket through the extension of local service.

One of the primary reasons why the Bell and other systems have been able to provide more and better service without adding materially to the cost is the widespread use of automatic switching or dialing. Bell Company officials claim that without dialing the telephone would be in the luxury class because of today's prevailing high labor costs—out of reach of many hundreds of thousands of people who now enjoy it. Although the actual number of operators employed exceeds that of previous years, many thousands more would be required to take the place of dial equipment. Too, it is speculative whether telephone companies could manage to find and train the great force that would be needed.

Many of us tend to look on the dial telephone as a relatively new development, yet as early as 1919 a complete Bell System exchange was converted to dial operation. Even before the turn of the century research aimed at automation had been undertaken, and some of the basic patents in the field were issued at that time. Broadly, the dial system is an automatic mechanical and electronic method of carrying out in sequence all the functions an operator would have to perform to complete a call.

Step by step, automatic switching of telephone calls follows the manual routine previously described. In place of facile fingers, however, small electromagnets take over the job of making connections. The eyes of the operator are guided to the proper jacks by visual signals—a light which signifies that someone wishes to place a call and a special numerical arrangement of the other jacks which permits her instantly to locate the one linked to the called line. Electronic instruments can "see"; that is, they can sense light. But in the case of automatic switching equipment there is no need of that—other sensing devices not only locate the electric energy that normally would be used to power a lamp but also "count" to find the number called.

Similarly it is possible to design an automatic system that could, when ready

to receive your call, play back a record, "Number, Please?" But that would be unnecessarily complicated, so the equipment merely sends out a steady hum. Because people's voices differ so much it would be hard to build an instrument that would understand verbal symbols used to identify a telephone. Instead, electrical impulses are used: one impulse for number one, two for number two, etc. These pulses go out over the wires whenever you manipulate the dial on a telephone.

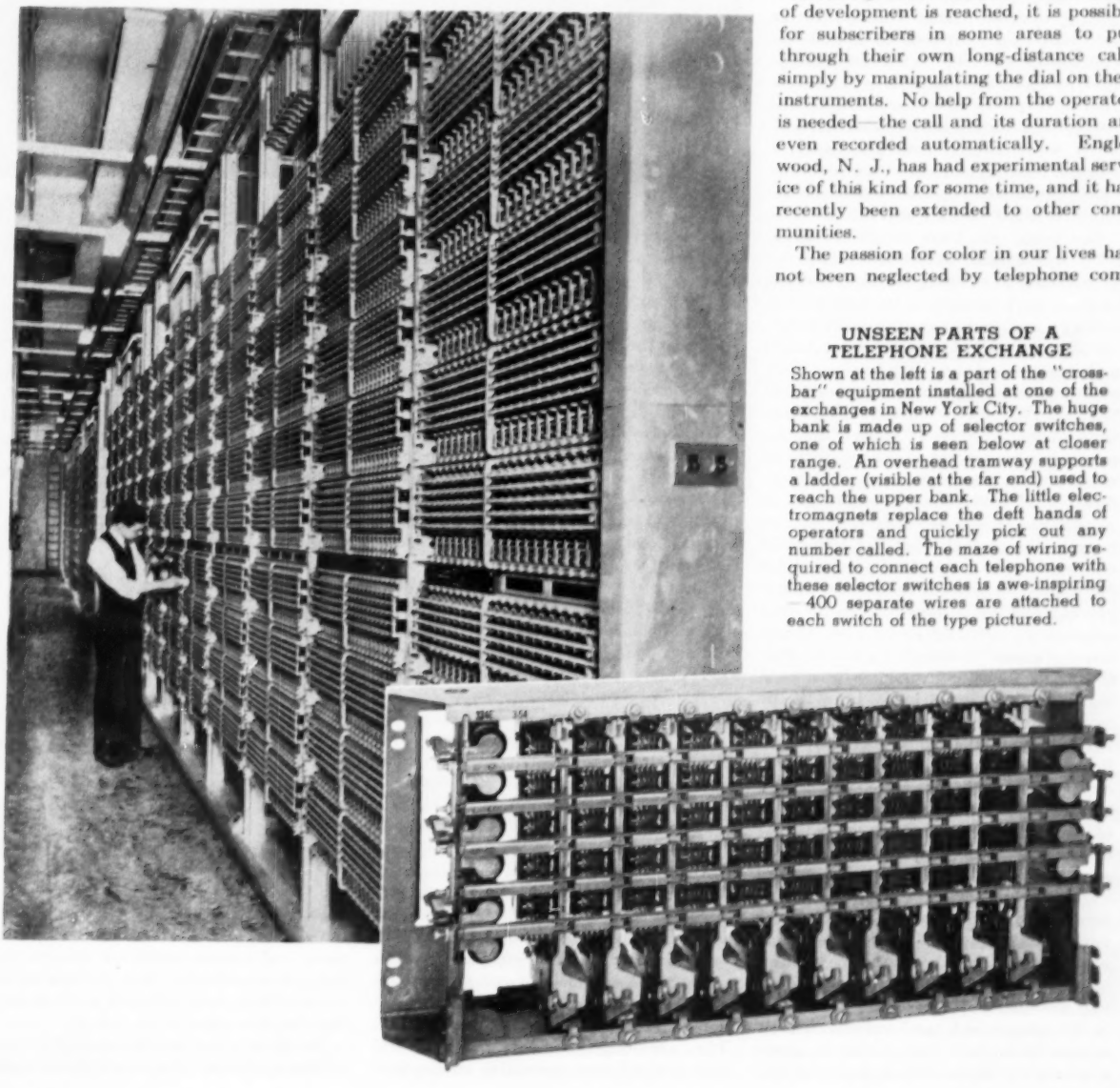
For each impulse an electromagnet moves a selector switch in the central office one notch. Within a split second after you have finished dialing, the switch has made a connection between your 'phone and the one you dialed. But, just as in a manual system, some means has to be provided to prevent interruption in case the line is busy. The same signaling mechanism that notifies an operator that a line is in use is suitable for this purpose. Again, a record-play-back device could tell you that verbally, but that, too, is superfluous: the machine simply sends a bzz, bzz, bzz over the wire as an indication that the line is in use.

If the line is not busy, the equipment proceeds to ring the called party, just as the operator does. As soon as the circuit is completed, ringing stops so that you may converse. When finished and you hang up, the break in the continuity of the circuit triggers the electromagnets and they return the selector switch to the neutral position. Thus your wire and that of the wanted party is cleared and the switch itself is released for another call from your 'phone or some other instrument.

No story about telephones would be complete without a resumé of some of the postwar developments that have improved service immeasurably and that hold out great promise for the future. One of these is direct distance dialing. Already, operators in many exchanges throughout the country are putting through calls directly to given numbers in far-distant cities. Actually, the toll-dialing network differs little from the dial system most of us use. Each exchange connected to the network is assigned a code number, much like the number of a private 'phone. Switching is accomplished in toll centers—installations serving numerous exchanges—just as a local exchange serves many different telephones in its area.

Telephone officials state that it will not be long before nearly every Bell System exchange, as well as many owned by other companies, will be converted to toll dialing. Even now, before that stage of development is reached, it is possible for subscribers in some areas to put through their own long-distance calls simply by manipulating the dial on their instruments. No help from the operator is needed—the call and its duration are even recorded automatically. Englewood, N. J., has had experimental service of this kind for some time, and it has recently been extended to other communities.

The passion for color in our lives has not been neglected by telephone com-



UNSEEN PARTS OF A TELEPHONE EXCHANGE

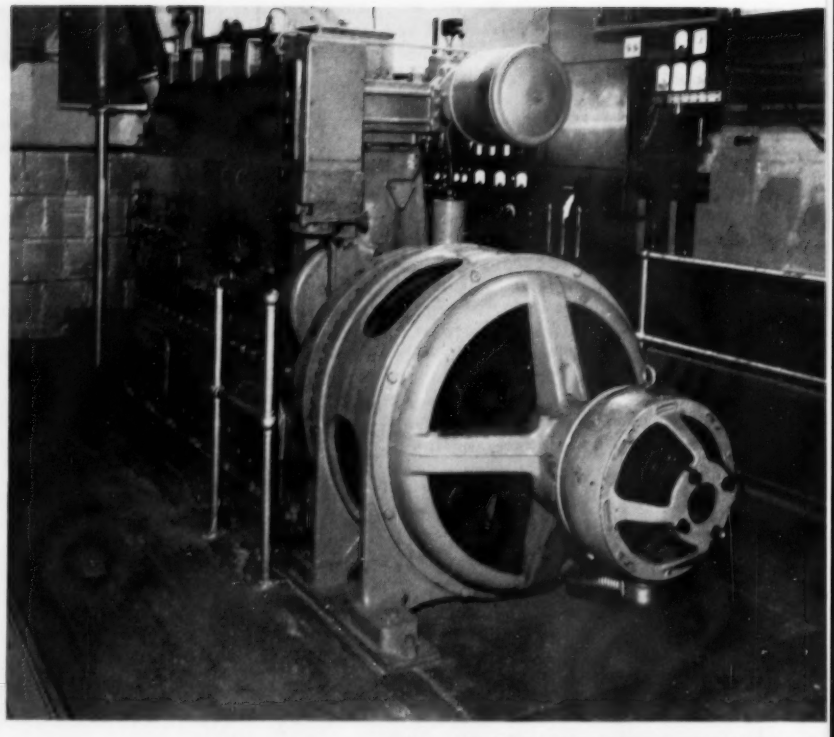
Shown at the left is a part of the "cross-bar" equipment installed at one of the exchanges in New York City. The huge bank is made up of selector switches, one of which is seen below at closer range. An overhead tramway supports a ladder (visible at the far end) used to reach the upper bank. The little electromagnets replace the deft hands of operators and quickly pick out any number called. The maze of wiring required to connect each telephone with these selector switches is awe-inspiring—400 separate wires are attached to each switch of the type pictured.

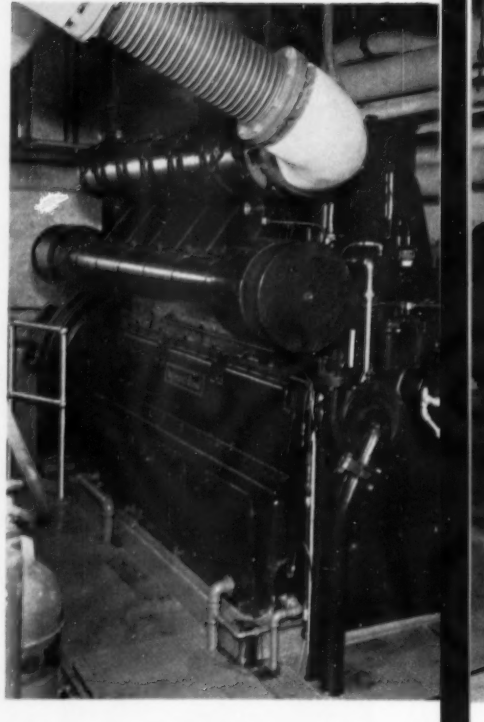
panies. Today, the familiar 'phone is more apt to match milady's over-all room decor than to be black because advances in the plastics field have provided color-fast materials of adequate strength. Instruments of ivory hue, available for many years, are growing in popularity. There are also innovations in set design for the benefit of the subscriber. One of the latest is the "Speakerphone" by means of which the busy executive—or housewife—can converse without holding the transmitter to his mouth or the receiver to his ear. The instrument stands on his desk, and he talks in ordinary tones with his hands free for other tasks.

Other "little things" can be added to the telephone, all intended to make it more adaptable and more convenient. Volume control on the bells, for instance, permits "turning up" the signal when some distance away from the set, or "toning it down" when nearby, during children's nap hours, or to adjust the loudness of the ring to the size of the room in which the instrument is located. Another type of volume control on the receiver enables the hard-of-hearing really to enjoy a telephone conversation. 'Phones with night lights that automatically illuminate the dial when the receiver is lifted also are available.

But while telephone people are naturally enthusiastic about the many improvements in set design and in service, they are even prouder of the recent enormous expansion of the system in America. The number of instruments installed and maintained by Bell System companies has actually doubled since World War II. At the end of the conflict there were about 23 million 'phones in their networks; now there are more than 46 million. But there are other growth indicators. During the war many people were asked to accept multiparty service because the central-office facilities could not handle the number of private lines for which there were requests. Today private service is available to all who want it in virtually every area except those of great "overnight" growth. Furthermore, many conversions have been made from 3- and 4-party lines to the more satisfactory 2-party service.

At the present time there are an additional 2000 and more Bell System exchanges than there were in 1945, and about 87 percent of the instruments are of the dial type, as compared with 67 percent at the close of the war. Besides, central offices have undergone marked improvement, and much outmoded equipment has been replaced by the newest and most efficient devices. Many of the latter are the result of wartime experience in miniaturization, electronics and automation. Even billing has come in for reappraisal, and automatic techniques have been introduced to assure the accuracy of monthly statements. (All this has been expensive: the value of the Bell System "plant"—the term used to identify all physical equipment owned by the companies—went up from about $5¾ billion in 1945 to more than $15 billion at the close of 1955.)





To describe all the equipment used in a telephone exchange and the function of each item would take up too much space and would, furthermore, be only of limited interest. Most subscribers are more concerned with the dependability of the service than with the actual workings of the equipment that makes it possible. Let us, then, take a look at what some companies are doing to insure continuation of service even in the gravest of emergencies.

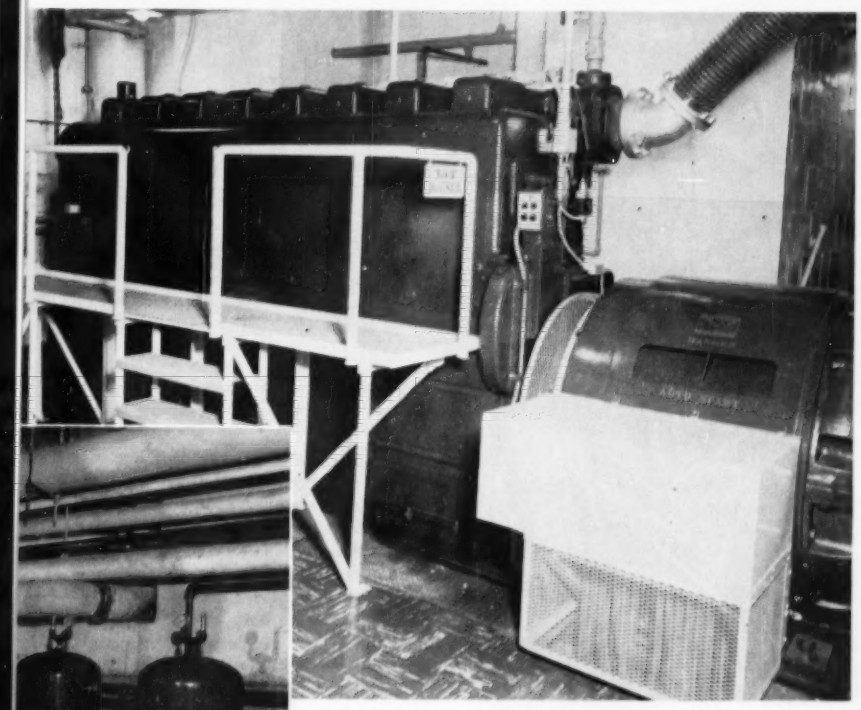
Our Government and our military leaders regard the telephone network that unites the country as a national asset. They consider it to be extremely important and practically invaluable at times of great disaster or war. One of the things which have been done to guard against failure is to provide alternate routes or circuits throughout the United States. These additional circuits, which also mean better service under normal conditions, have been and are being constructed by the Long Lines Department (a subsidiary that builds, maintains and operates long-distance lines) of AT&T.

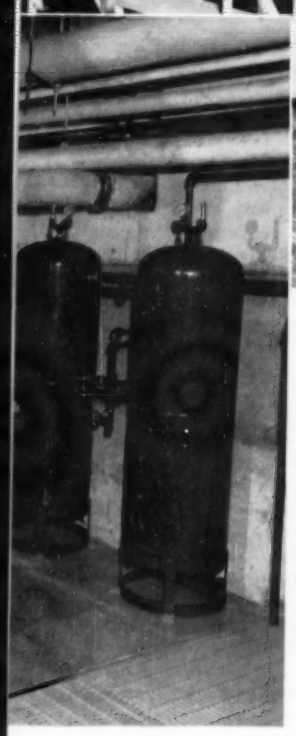
The routes by-pass critical target areas so that the channels of communication which link the nation will not be impaired should enemy bombers strike. They are designed to resist most natural destructive forces, providing service during floods and other emergencies. Likewise, some decentralization has taken place, toll centers which are vital to the network are established in sections which are not likely to be affected, at least during the early days of an assault.

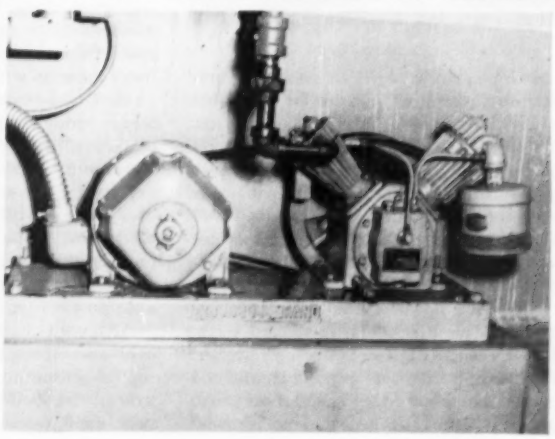
Needless to say, electric energy is vital to the operation of any telephone com-

DIESEL RESERVE POWER

If regular power sources should fail, New York telephone exchanges would continue to function with current supplied from standby diesel engine-generators, some of which are shown here. Below is an Ingersoll-Rand 8-cylinder, 600-hp Class TS heavy-duty engine connected to a 435-kw General Electric generator. This set was installed last year in the New York Telephone Company's building at 435 West Fiftieth Street. The first diesel provided for this service was installed in 1937 at the 104 Broad Street exchange and is seen at the upper-left. The engine at the bottom-left is a companion to the latter and was put in in 1947. Both units are 6-cylinder models and each drives a 300-kw generator. Exhaust from the diesels is piped to the flue or stack in their respective buildings. The engines are started with compressed air at 250 psi pressure, and the picture at the bottom-left shows two receivers in which it is stored ready for immediate use. The tanks are kept charged by the I-R motor-driven, air-cooled compressor at the bottom-right.







pany. Most of our exchanges are supplied with power from local utilities. As all of us are aware, electric service has become extremely dependable in most parts of the country, there are few power outages, and most failures last only a short time. Unfortunately, power may be cut off for an appreciable period when disaster strikes, and the chances are that telephonic communication will be needed to help fight the emergency. Sometimes its availability is a matter of life and death; then, again, great monetary losses may result if service is not maintained. Consequently, diesel-generator standby units have been installed in certain exchanges to insure a continuous supply of electricity.

New York has more telephones than any other city on earth, more than those listed in Chicago, which comes second, and London, third, combined . . . more even than any country except Canada and the United Kingdom and, of course, the United States. On an average there is one 'phone in New York City for each 2.15 persons. (Washington, D. C., leads the world in this respect with one instrument for each 1.62 persons.) On a statewide basis, nearly two-thirds of all the telephones owned by the Bell System affiliate are in or immediately adjacent to New York's five boroughs. The 4,000,000 instruments in that area are served by 312 exchanges. And, as our leaders warn us, New York will be a critical target in case of war.

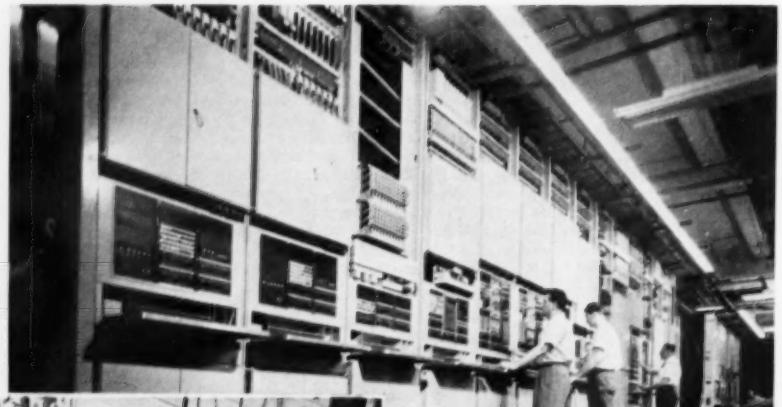
One of the greatest advances in telephony was the introduction of "common battery" service by which all telephones in an exchange are powered from the central office. Prior to that development each instrument had its own sources of power—a battery of two 1½-volt dry cells to energize the voice circuit and a hand-cranked magneto to supply ringing current. By the present system all individual batteries were moved to the central office.

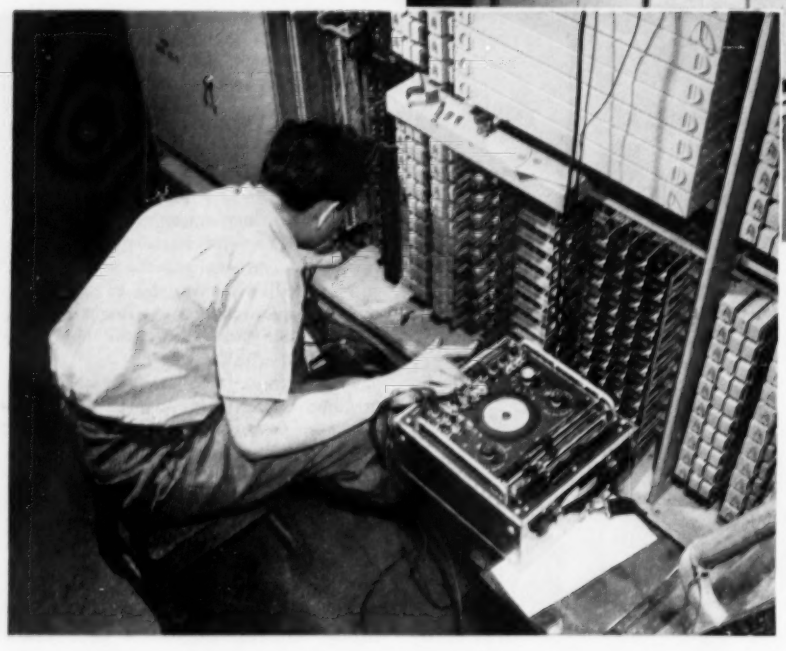
Today, most telephone exchanges are powered by battery current. Often the cells are not of the type familiar to most of us; many are giant storage units that are far larger than those in an automobile . . . are similar to those aboard submarines except that their ampere-hour rating must, in many cases, be even greater. The cells are kept charged at all times with, as we have already said, current purchased from a local electric utility, the exchanges on Manhattan Island being no exception. Now, should energy fail, big standby diesels can be started up within seconds. In the brief interval that elapses between power interruption and the beginning of emergency power service the battery continues to supply the needed electric energy. In fact, it could probably provide enough for the duration of most power failures, but it is apparent that it would be unwise to wait until the battery was almost discharged before bringing the diesel units into action.

Standby power for telephone exchanges is not new, at least not for many of those on Manhattan Island. As early as the 1920's gas engine-generator sets were installed that used city gas. The disadvantages of an outside source of fuel were immediately apparent, and several years later some of the exchanges were equipped with gasoline-engine generators. However, it became evident that the nature of the service was such as to require a really heavy-duty and dependable driver. For example, it might happen that there would be no

TEST EQUIPMENT

Both installing central-office equipment and keeping it functioning correctly are big jobs. An installer of switching equipment, below, is assisted by a portable test board in hooking up the apparatus. New York City subscribers having telephone numbers beginning with "Digby-9" are served by the equipment shown. The giant panel pictured at the right is employed solely to keep tabs on the operation of other equipment in the exchange. By proper use of the panel, "trouble shooters" can run down almost any malfunctioning of apparatus that occurs. The instructions covering the operation of the panel fill several good-sized volumes.





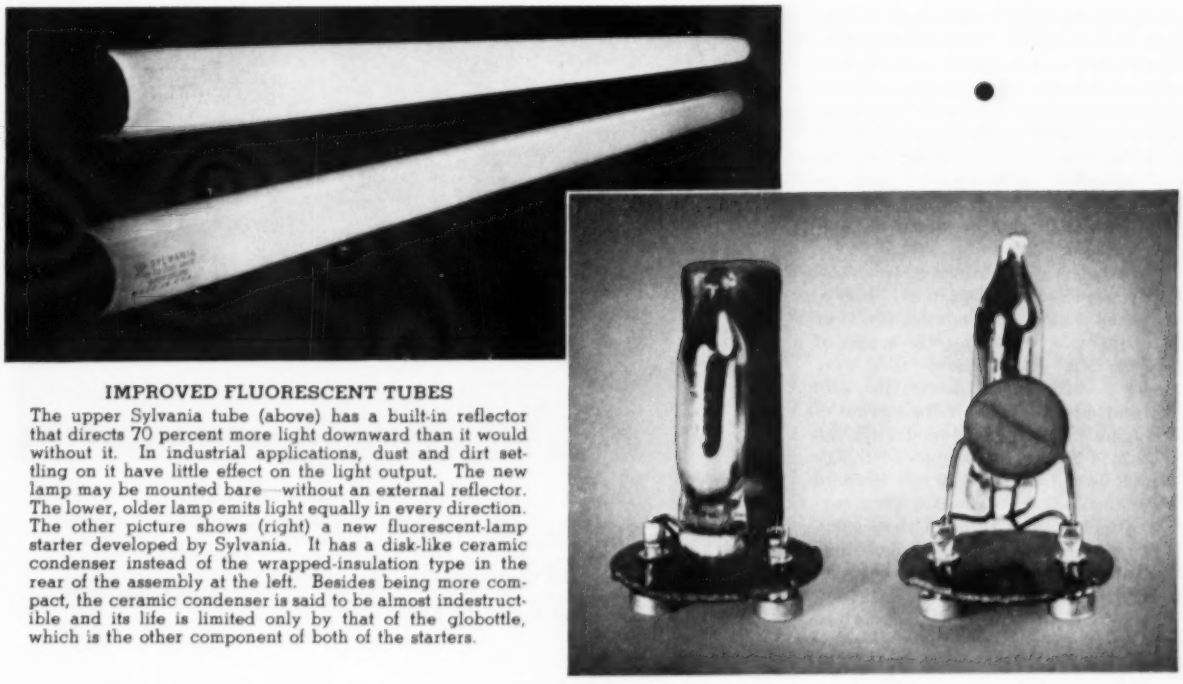
demand for emergency power for several years. Yet when the need did arise the units would have to be put in operation immediately and run continuously at full load until normal power from outside was again available.

The New York Telephone Company began to look into the inherent advantages of the heavy-duty, stationary diesel engine in 1936. Soon the first order was placed, and in 1937 some New Yorkers were insured against service interruptions by the first diesel-electric standby installation. Today every Manhattan exchange has sustained emergency service. Most of the reserve units are on the lower subfloors of the buildings where they are out of harm's way, and are self-sufficient for periods of a week or more. Some of the earliest ones depended on city water for cooling, but now many are converted or are being converted to independent operation by means of a closed cooling system incorporating fan-cooled radiators.

Among the first exchanges on Manhattan to be provided with a diesel-powered standby generator was one in the downtown financial or Wall Street district. The engine is an Ingersoll-Rand Type S and drives a 300-kw General Electric generator. A duplicate set was installed just ten years later, in October 1947. Both engines are 6-cylinder units operating at 720 rpm. They are started by admitting air at 250 psi pressure directly into the power cylinders in firing sequence, the air being furnished by an I-R Type 30 high-pressure compressor. Full load is imposed as soon as the machines reach operating speed—no warm-up or stabilization period is allowed. To make sure that each engine is in service condition at all times it is run for one hour once each week, eight hours once each month and nine hours once each quarter, and careful records are kept of their performances. Combined, they supply standby power for a number of exchanges all located at 104 Broad Street. (Other I-R engines—a total of nine on Manhattan alone—supply many other exchanges with emergency power. Together, they have a rating of 3329 kw.)

From an economic standpoint the installation of large, heavy-duty units of this kind is an expensive business, especially when it is considered that they may not be needed for several years at a time. Of course, though no figures are available to prove or disprove it, the engines might pay for themselves over and over again in one short period of operation. Maintenance, too, could be a big item under such conditions. In fact, many diesel engineers claim that it is harder on a machine to be on standby duty than to run all the time. That is one of the primary reasons why The New York Telephone Company chose heavy-duty diesels. Some condensation, for instance, takes place in all engines when they stand idle, the amount of damage done by the water depending on the thickness and the kind of metal of which they are built. The heavy-duty type stands up better in this particular field than the lighter-weight engine, which is useful elsewhere in portable power rigs, etc.

Although machinery plays an important and steadily growing role in providing telephonic communication, a cardinal rule of the Bell System is that its business shall essentially remain a service performed by a comparatively small number of people for millions. The importance of the human element, so far as it concerns the dependability of the service rendered by The New York Telephone Company, is exemplified by a special training program which, by the end of 1955, had qualified more than 10,000 of its 81,000 employes for special civil-defense and emergency duties.



IMPROVED FLUORESCENT TUBES

The upper Sylvania tube (above) has a built-in reflector that directs 70 percent more light downward than it would without it. In industrial applications, dust and dirt settling on it have little effect on the light output. The new lamp may be mounted bare—without an external reflector. The lower, older lamp emits light equally in every direction. The other picture shows (right) a new fluorescent-lamp starter developed by Sylvania. It has a disk-like ceramic condenser instead of the wrapped-insulation type in the rear of the assembly at the left. Besides being more compact, the ceramic condenser is said to be almost indestructible and its life is limited only by that of the globottle, which is the other component of both of the starters.

Light by Sylvania

Compressors and Vacuum Pumps Work Behind the Scenes To Bring Us the Miracle of the Electric Lamp

G. B. RICHARDSON and ROBERT JAMES

BACK in 1879 Thomas Edison successfully demonstrated his theory that a long-lived electric lamp could be built by enclosing the filament in a glass envelope and evacuating the assembly. Since then the lighting industry in this country has made steady progress, earning the United States the sobriquet of "the best lit nation in the world." And vacuum and the electric lamp have been linked in a development that has been of inestimable value to our civilization. Today's lamps and their uses are so varied that they defy enumeration, but it is interesting to note that each well equipped modern automobile has about 22 to 25.

Statistics for last year show that about 1079 million lamps of all types were produced in the United States—975 million of the familiar incandescents and 104 million tubular fluorescents. In addition, 500 million photo flash bulbs were turned out. Our use — and enjoyment — of lamps has grown tremendously in the decades spanning the depression and World War II, and the fourfold increase may be said to be indicative of our desire to "get more light on the subject."

Sylvania Electric Products, Inc., one of the "big three" lamp producers, is a 56-year-old firm that traces its origin to two roots: a New England branch and the Pennsylvania organization that gave it its present name. The industrial enterprise that was to become the giant Sylvania organization was launched at the turn of the century when Frank A. Poor bought a $3500 half interest in the Merritt Manufacturing Company in Middleton, Mass. In a few years Poor bought out his partner for $750, a figure which shows that he took over a venture that was not in the best of health.

Moving to Danvers, Mass., and renaming the firm the Bay State Lamp Company, Poor carried on a business of renewing burned-out light bulbs. The older types of lamps had sharp tips, evidence of the tubes through which the contained air was exhausted at the time they were made. In the restoration process each lamp was washed and the tip broken off to give access to the filament, which was withdrawn with a tool resembling a buttonhook. Because it was a carbon filament it left a deposit inside the bulb that had to be burned out by a gas flame before a new filament was inserted and the bulb evacuated through a rebuilt tip.

From this humble start the company progressed until 1909 when the owners of the Bay State Lamp Company formed the Hygrade Incandescent Lamp Company for the purpose of manufacturing and selling new lamps (Bay State continued the renewal or "refilling" business until 1913). At about the time the Hygrade Company was organized, research and the quest for quality made their appearance on the scene in the person of Walter Poor, a graduate electrical engineer and brother of Frank, by then chairman of the board, and Edward Poor, another brother and president. Walter developed a small lamp with a tungsten filament for illuminated signs. Its performance in the laboratory showed it to be far superior to the carbon-filament type, and a special drawing process was devised to form tungsten wire of sufficient strength for the application. However, the new lamp proved to have a disappointingly short service life, and the brothers devoted themselves to finding out "why."

Edward made a trip to New York City and spent his evenings atop buildings in Times Square replacing lamps which had failed. These he sent back to Walter hard at work in the laboratory. There, close examination indicated that vibra-

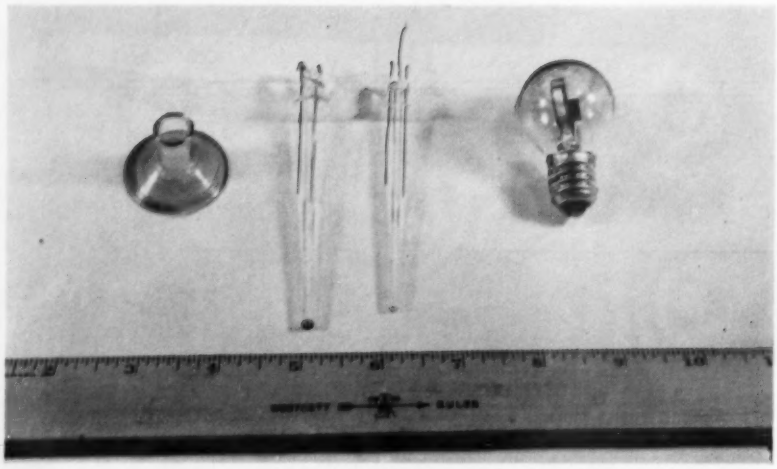
tion set up by high winds might be the cause of the trouble. Accordingly, a filament anchor was designed, and the new tungsten-filament lamps began to fulfill their early promise of superiority. That dogged approach to their objective and the refusal to accept anything but the best were the beginning of a program of research and quality control that has been continued by the successor company.

The other branch of the Sylvania family tree goes back to 1906 in St. Mary's, Pa., when a group of men decided that there might be a market for lamps of novel shapes. But because they were unable to find a glassblower, the firm they started rebuilt old bulbs instead of producing new ones as planned, although it retained the original name of Novelty Incandescent Lamp Company. Bernard G. Erskine, an early associate of the concern, stuck with it through the vicissitudes of a business recession and changes of owning interests to become manager and part owner.

Then in 1924 the organization formed a separate firm to manufacture radio tubes. The subsidiary was called Sylvania Products Company, and in 1931, with the dissolution of the parent concern, merged with the Poor family's Hygrade Incandescent Lamp Company under the name of Hygrade Sylvania Corporation. Mr. Erskine was named president and Edward Poor served as first chairman of the board. After the formal merger, however, headquarters were maintained for both branches, thus establishing a management policy that has continued to the present day and that gives each of Sylvania's 45 plant managers a large degree of autonomy and responsibility in the conduct of the business.

The factories are located in eleven states from Maine to California and provide employment (including central-office personnel) for well over 25,000 persons. It also maintains sixteen laboratories. In 1942 the corporate name was shortened to Sylvania Electric Products, Inc., thus clarifying the nature of its business, which had expanded into several different but allied fields. Today, lighting and the manufacture of radio tubes, on which the present company was founded, are but two of its nine divisions. The others are: Television Picture Tube, Electronics, Radio & Television (receivers), Electronic Systems, Atomic Energy, Tungsten & Chemical, and Parts.

Sylvania's history might be summarized as growth despite a generally adverse economic outlook, because the major steps in its development came in 1907, 1914, 1921, 1929, 1931 and 1941-45, all years just before or during depressions or wars. In the same spirit the firm's chairman of the board and president, Don G. Mitchell, stated in the



BASIC PARTS OF AN INCANDESCENT LAMP

A flare (left); a flare with the evacuation tube and part of the filament structure added (center); and a finished "ozone" lamp showing the bulb and screw-type base. Larger and smaller lamps are but variations of the same basic structure. Lamps of 25 watts and smaller are exhausted to a high vacuum just before sealing. Others are first evacuated and then charged with one of several inert gases, the choice depending on the lamp's intended use.

now-almost-forgotten gloomy days of early 1954, when there was widespread fear of a recession, that he considered such pessimism unwarranted; that the conditions foretold only a "minor downturn." In a widely quoted analogy he compared the economic "gloomsters" with the golfer who finds Sunday's 86 a cause for breast-beating after Saturday's 85. Needless to say his optimism and that of his company were justified. He acted upon his belief as well; several new plants projected about that time have been completed since then.

A few years ago the quotable Mr. Mitchell said in an address to the American Newcomen Society: "Nature abhors a vacuum, but we love it! In fact, no small part of our success is due to the quality of our vacuum." The importance of this cousin of compressed air in the scheme of things at Sylvania was not overemphasized, for the functioning of most of the company's products and their handling in various stages of manufacture are dependent upon it. Compressed air plays an equally important role, as will be seen from a quick look at the operations in two of Sylvania's Lighting Division plants in Massachusetts.

The division has ten factories, six of which are in the New England States, two in Pennsylvania and one each in Kentucky and West Virginia. They turn out lamps of all sizes from miniatures to huge floodlights, and in types that include mercury-vapor, infrared, germicide, zirconium arc and photoflash, as well as the better-known incandescents and fluorescents. The plant at Danvers, Mass., a modern 2-story structure that is air-conditioned throughout, produces the bulk of the company's fluorescent lamps—more than 300 kinds and sizes. This output places Sylvania second among fluorescent-tube manufacturers. An offshoot of this business is the making of fluorescent fixtures, a line that is unique among lamp producers and gives Sylvania the advantages of matched fixtures, ballasts, condensers, etc., for their lamps. The fixtures are available in 350 types and sizes and are designed for both industrial and residential illumination.

At Danvers, operating vacuum is drawn by three rotary pumps from which lines run throughout the plant. The compressors—Ingersoll-Rand single-stage, nonlubricated machines—supply air at 100 psi. For air at lower pressures there are multistage blowers which are installed in the same machinery room for centralized service and control. After a fluorescent lamp has been pumped out to a high vacuum, surface gases are removed from the interior by flushing with pure argon, the two operations tending to clean it out better than pumping alone. The lamp is finally filled with argon at low pressure.

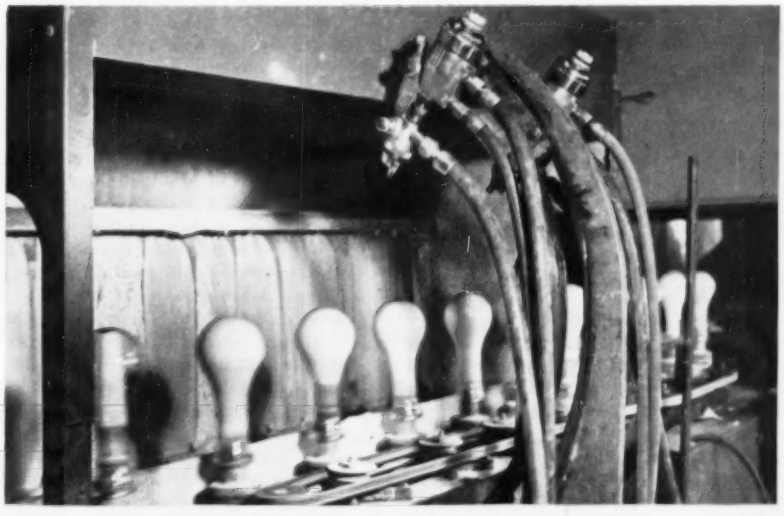
Blank glass tubes entering the plant are inspected for damage, automatically washed, dried and placed on a conveyor system that carries them on their way through the various coating, drying, assembly and evacuating processes required to turn out a finished product. The inside of the tube is given a phosphor (fluorescent) coating. Received in drum lots from Sylvania's Towanda, Pa., plant, the phosphors are first dispersed with powdered lacquer and pigments in pebble mills. An interesting facet of this relatively simple operation is that just any pebbles won't do—special ones from the beaches of Brittany, France, are im-

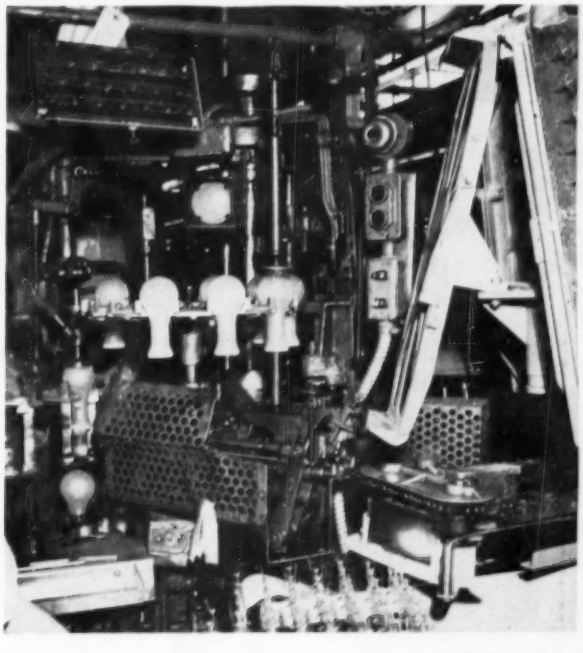
ported. Their hardness and superior resistance to chipping prevent contamination of the mixture. Compressed air is of aid in this work as it is needed to blow the phosphor mix from the mills into glass-lined storage tanks where it is held until combined with a liquid carrier preparatory to being applied. The nonlubricated construction of the compressors is vital in the latter service because it prevents oil contamination of the coating material.

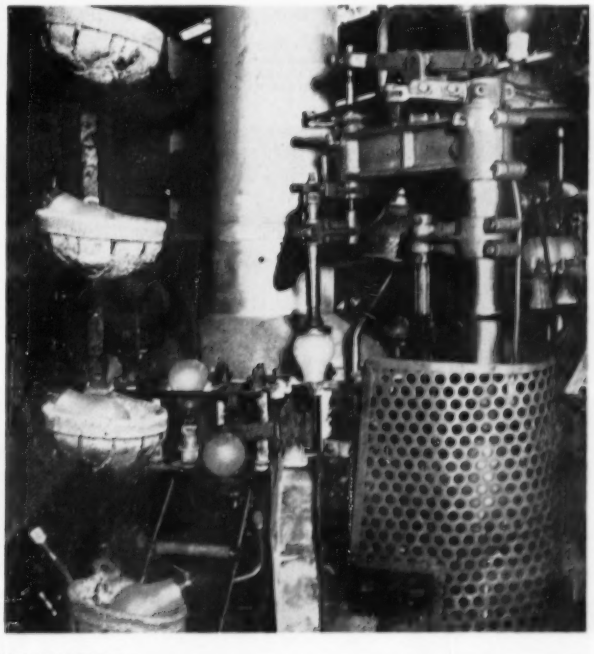
The glass tubes are upended and lined by gravity flow, the exact amount of phosphor introduced into each one being controlled automatically. This metering, plus a carefully regulated, staged drying process in continuous ovens results in a fluorescent coating that is neither too thin nor too thick—that would pass too much ultraviolet light in the first case and reduce the output of visible light in the second.

After lining and drying, a tube is ready for the insertion of the electrical elements that make it a lamp. The machines that produce the stems and flares, as they are called, are good examples of automation and predate by many years the current preoccupation with the idea. The flare-making machine, for example, has seven stations where (1) the blank glass tubing is heated; (2) the heated glass is flared; (3) the flared portion is squared up—made level; (4) the length of the flare is accurately gauged; (5 and 6) heat in two steps is applied to a thin stripe around the stem of the flare; and (7) the flare is cut from the tubing by a cutting wheel.

Every one of the functions mentioned is critical, and any of them, if performed incorrectly, would spoil the flare. Heat is applied by gas flames the Btu value of which is carefully controlled by means of combustion air supplied by Ingersoll-Rand Class MM blowers. The glass blanks remain at each station for a specified time, and the flame must impinge on the tubing at just the right angle and







STEPS IN BULB-MAKING

Clear glass bulbs are coated with a varicolored ceramic glaze or frosting, which is sprayed on with air as shown at the top. The spraying compound is also mixed by air power, which is preferred because one of the ingredients is highly flammable. Before assembling flares, bulbs and bases, the Sylvania trademark and voltage and wattage ratings are stamped on the inside of each bulb by a machine (lower-left) that uses both compressed air and vacuum. As a bulb moves in from the left, a vacuum transfer arm lifts it into place on a rotating indexing table. It is then moved around to the marking station where an air-cylinder piston with dies on its end enters the bulb through the base and marks it. When the bulb and flare meet, a lamp is born and the machine at the right turns the trick at the rate of 1350 an hour. After the flare is positioned in the bulb the parts are fused together by gas-flame jets and the excess glass or bulb skirt is removed (one can be seen descending the lower-center chute). A vacuum transfer arm then lifts each lamp to the evacuating station where a suitable connection is made with a small tube that has been left in the flare, and the air is exhausted. Still under vacuum, the tube is sealed hermetically. During the next step the base sections are added to complete the lamp.

temperature so that the glazing operation will be successful and the glass will not break. Heating before cutoff is critical, too, because the cutting wheel might crack glass that is too cold and mash that which is overheated.

A controlled directional blast from the gas flames at the stem-making stage forces the molten glass around the lead wires, forming a hermetic seal. The lamp stems are sealed into the coated tubing, and the lamp is then exhausted and bases are added. Various operations such as cutting off lead wires and forcing cement into the bases are aided by air cylinders.

Many of the company's incandescent lamps are manufactured at the Loring Avenue plant in Salem, Mass.,* where as many as 1500 different types, ranging from giant 1000-watt floodlights to a special kind that generates ozone to kill odors, are made (company-wide, a total of 4500 models are turned out). There, too, vacuum and compressed air are vital to production and are available everywhere throughout the factory. Vacuum not only serves to actuate machines which take the place of much tedious (and expensive) handwork but also to exhaust bulbs in the final stages of manufacture. Bulbs are brought in from an outside source, and, of course, compressed air was used to form them.

*Sylvania just recently completed a new incandescent lamp plant at St. Marys, Pa., which manufactures standard "A" line lamps and has been described as being the most modern incandescent lamp factory.

For all practical purposes, the production lines at Loring Avenue can be designated as "Y's"; the bulbs flow along one branch, the flares or filament assemblies are finished on the other, and the two parts come together for the last steps. After the bulbs are received and have passed inspection, those that are to be glazed or otherwise treated are delivered to their respective stations. Colored bulbs are sprayed with a ceramic paint and glazed in an oven at 1400°F. Spraying is done with compressed air, which also powers the mixer that compounds the coating solution.

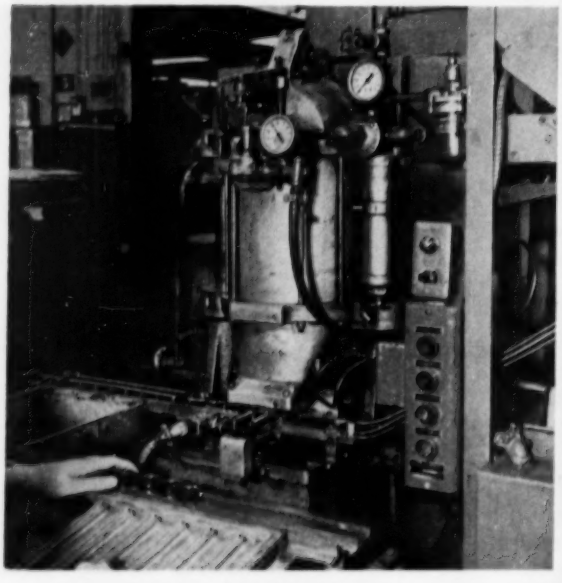
Power companies estimate that about 30 percent of the approximately 300 billion kilowatt-hours of electricity produced in the United States each year is used for illumination.

Some bulbs are lined with a thin layer of aluminum or silver. Known as aluminizing, the operation is accomplished by vaporizing aluminum or silver in the bulb while it is under a high vacuum. Vaporizing is done by a carefully controlled heated tungsten filament, and the vacuum (a pressure of only about one micron is tolerated) is drawn by oil diffusion pumps. Other lamps—types familiar to most of us because they are used in the home—are frosted on the inside by an etching process.

When the bulbs are ready for finishing they must be labeled with the company's trademark and with the required voltage and wattage. Both air and vacuum play a big role in this operation, which is performed before the flares are sealed. As each bulb reaches the marking machine it is met and picked up by a vacuum-cup transfer arm which deposits it on a circular table that indexes it to the marking station. There a clamping fixture descends to hold the bulb in place and a rod with the proper dies on its tip enters it through the base and stamps it on the inside. The rod is powered by an air cylinder.

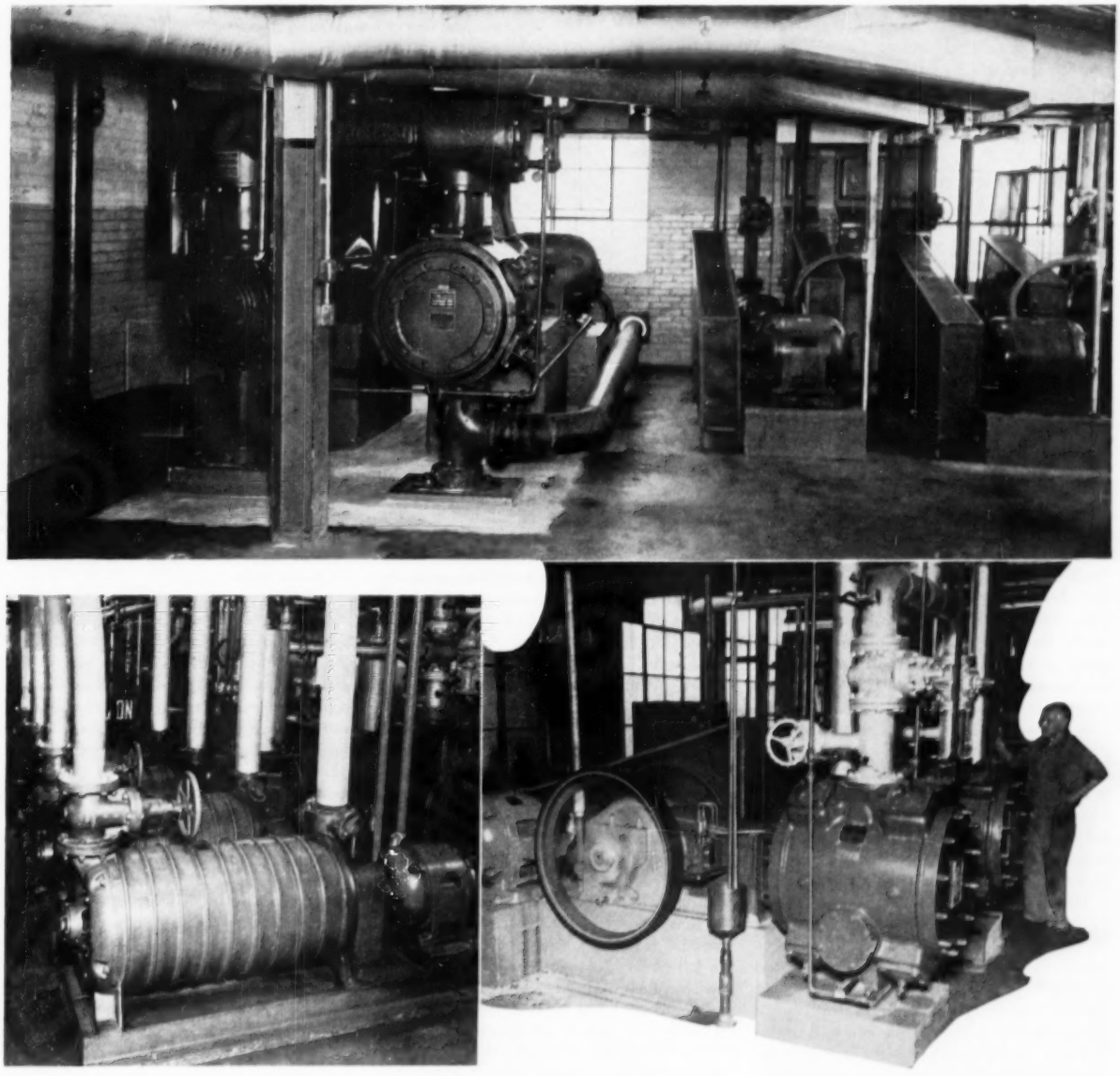
Like many other automated machines, the marking units have built-in devices to guard against errors made previously in the production line. One of these protects the dies against damage which might occur if a bulb were not delivered—in that event the dies would strike the hold-down clamp and could be ruined. To obviate this a jet of compressed air is aimed at each bulb as it enters the marking station. If the bulb is there it deflects the jet and the cycle is completed without pause; but if the station is empty, the air impinges on and triggers a small lever which prevents the marking cylinder from functioning.

The flares for incandescent bulbs are made in about the same way as those for fluorescent lamps and the needs for compressed air and vacuum are much the same. There are differences, of course,



AIR MUSCLES

The pressure extrusion device shown above uses air at 45 psi to force rings of Bakelite cement into the bases or caps that fit over the ends of fluorescent tubes. When the caps and contact points are in place, the assembly is baked to set the cement. After lamps have been packed for shipment air power lends a final helping hand (right) by lifting the cases from the packing station onto an outgoing conveyor line.



AIR AND VACUUM SUPPLY

These Ingersoll-Rand machines furnish the compressed air and vacuum that work hand in hand at the Loring Avenue plant in Salem, Mass. At the left in the picture at the top is a 2-stage Type XRB compressor with a capacity of 630 cfm. On the right, with their cylinders at the other end and obscured, are two single-stage Class ES units each rated at 146 cfm. All three discharge at 100 psi pressure and have nonlubricated cylinders with piston rings of a graphitic material so as to supply oil-free air. The picture at the left shows four I-R blowers that provide the gas jets with combustion air. Each has a capacity of 650 cfm at 4½ psi pressure. At the bottom-right are two Class ES vacuum pumps rated at 26 inches of mercury. They serve vacuum transfer arms and other low-vacuum purposes.

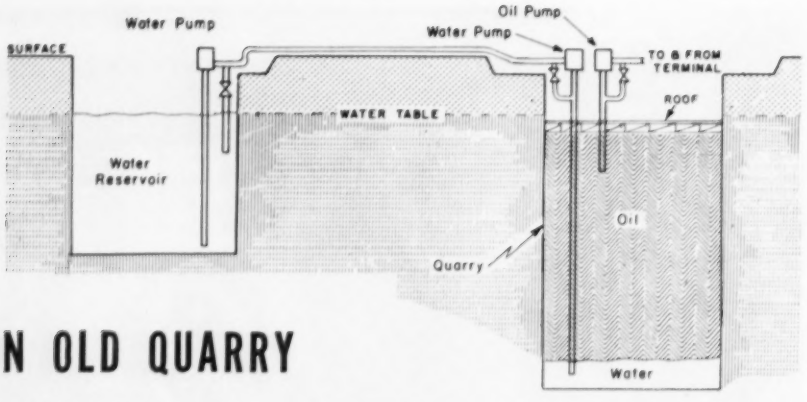
in the dimensions and in the filaments, but they have little effect on the basic production equipment.

When the two subassemblies, so to speak, meet at the base of the "Y" for finishing, the flare and the bulb are joined by carefully controlled directional gas-flame jets which fuse both pieces of glass into one, as in the case of the fluorescent lamp. Vacuum bulb lifters also come into action. They work automatically and lift the bulbs from a loader-conveyor to the initial station and also transfer them from one indexing table to another at one point in the cycle.

In the final stages of conversion from bulbs to lamps (a fine distinction, to be sure, but one that is carefully observed by lamp producers) the former are exhausted to a high vacuum—as are lamps of 25 watts and lower—or the air is removed and replaced with an inert gas to achieve some special effect. Vacuum is applied to each bulb independently so that one defective envelope will not in any way affect good ones. The bases are then attached. Following final inspection, each lamp is ready for service, but compressed air has one more job to perform. After packaging, a lifting device powered by a pneumatic cylinder takes over the work of placing the cases on an outgoing conveyor line.

While the two plants described are by no means representative of all Sylvania's manufacturing establishments, or even those operated by the Lighting Division, they do give an idea of the importance of compressed air to the company and show why Nature and Sylvania Electric Products, Inc., are at odds in their respective views about vacuum.

Alpha and Acme



OIL STORED IN OLD QUARRY

Esso Standard Piped Nearly a Million Barrels to and From Former Pennsylvania Slate Pit in a Year

WORKING PRINCIPLE

Water is transferred to and from the reservoir (left) into the oil storage pit as required to compensate for receipts or withdrawals of oil. The latter floats on the water, which is always kept at least 20 feet deep to make sure that no oil will be drawn off with it. Pressure of the surrounding ground water against the oil prevents the latter from escaping into the rock.

STORAGE of heating oil in an abandoned slate quarry at Wind Gap, Pa., has been termed successful by Esso Standard Oil Company following the first year of full-scale experience. The facility, which is the first of its kind in the United States, was placed in operation in October, 1954, too late to permit using it much during the remainder of the fall and ensuing winter. Last year, however, 969,000 barrels of oil was pumped into it during the warm-weather months and out again during the 1955-56 winter. This volume was only 31,000 barrels short of the million it had been estimated the pit would hold. No difficulties were encountered in the operations, and virtually no oil was lost.

Esso Standard embarked on the quarry storage venture because it promised to be more economical than using conventional steel tanks. Studies indicated that only 10 percent as much steel and about one-third as much ground space would be needed, depreciation and maintenance costs would be less, and damage from storms or bombing negligible. Storage of heating oil has to be reckoned with because its consumption is highly seasonal. Most of it is used during the five months starting with November. However, oil companies must be able to meet the demand, and that calls for stockpiling.

Actually, in modern refinery practice, a certain amount of oil of this grade is made all the time, although there is enough flexibility to permit varying the percentage considerably. It is most practicable, then, to turn out some the year round and to increase its production during the period of greatest use. This calls for storing a percentage of the warm-weather output, and that has traditionally been done in cylindrical steel tanks containing around 150,000 barrels each. These are costly, and as a precaution against fire it is customary to allow about two acres for each tank. Thus, storage for a million barrels normally requires around fourteen acres. At Wind Gap, however, it is being provided in five acres.

The Wind Gap installation actually consists of two old quarry pits situated only a few hundred feet apart. One, called Alpha, holds the oil, and the other, designated as Acme, is a reservoir for water, which is essential to the operation. Alpha measures about 250x350 feet at the surface and is up to 225 feet deep. The water table is about 40 feet below the surface and varies only 2 or 3 feet even in the driest year. This ground water continually exerts pressure at every point, and as the oil is always below its level none of it can escape into the enclosing rock. At several places around Alpha wells were driven from the surface to a depth below the water level and cased. Through them the water-table elevation is checked at regular intervals, and any significant lowering would be detected in time to take counteracting steps in the quarry arrangement.

To be on the safe side, the top of the oil pool is kept about 15 feet below the normal level of the ground water. That is done by using water from quarry Acme as a balancing fluid. Being heavier than the oil, the water remains at the bottom of Alpha and the oil floats on it. As oil is put in or taken out, water is removed or added so that the surface of the oil is always substantially at the same level. Actually, more water is taken out than is put in because springs on the upper slopes of Alpha contribute a steady flow to the oil reservoir.

To prevent dust and other air-borne contaminants and wild life from getting into the oil, as well as to protect it from direct sunlight and evaporation, a steel-pontoon roof floats on it. It is composed of about 240 shallow boxes with $\frac{3}{16}$-inch walls. Each standard unit is 32 feet long, 7½ feet wide and 1 foot deep and weighs 2¾ tons. Around the rim of the irregular opening are specially shaped members that had to be tailored to fit. All told, about 700 tons of pontoons cover the 56,000 square-foot area. They were welded together to form a continuous roof, and adjacent ones are also clipped together along the edges, which rise above the general level. A neoprene apron extends from a shelf around the quarry walls to the roof to cover the open space around the perimeter of the pit, and cables with coil springs are anchored to the walls and roof to keep the latter centered at all times. This gives the roof some leeway in elevation, although its vertical travel is limited to about 18 inches.

The oil comes from and is returned to a Standard Oil refinery at Linden, N. J., 65 miles away. It travels in a 6-inch pipe line, the existence of which was one of the reasons why the quarry storage idea was tried out. The line is leased from Tidewater Oil Company and was one of the earlier links in its system, having been laid prior to the turn of the century. Despite its long use, it has developed no leaks during its current service. Pumping of oil from the refinery to the quarry starts in April and continues at a rate of 250,000 gallons daily until the following November. With the arrival of cold weather, the fuel begins to move back to Linden at a rate of up to 400,000 gallons daily. From the refinery it is delivered to secondary distribution points by barge, tank car and tank trucks.

A 210,000-gallon storage tank was erected at the edge of the Wind Gap oil reservoir to permit checking the accuracy of the meters recording the flow. (Teletype communication facilitates frequent and fast reporting on the quantity pumped so that a leak would soon be de-

THE UNVEILING OF ALPHA

When the converted quarry storage reservoir was dedicated on October 21, 1954, a helicopter lifted a canvas sheet from a 100-foot-long Esso oval trademark painted on the roof. Pumps are located on the platform at the right. This is said to be the largest oil-storage facility in existence. The second abandoned pit that serves as a water reservoir is nearby. Houses in the background are in Wind Gap.

tected.) The tank will also permit any oil-water emulsion to settle should it ever become necessary to remove the last few inches of oil from the quarry. Trucks making local deliveries are filled at this tank.

The old adage that oil and water don't mix is borne out here. Water that is pumped back from Alpha to Acme shows no trace of oil. As evidence that the water reservoir is not contaminated, fish thrive in it. The water that comes back, first enters a small, separate enclosure, a precaution that would permit skimming off oil, should any be carried over, before it has a chance to do damage. The returning water can be jetted upward from beneath the surface—made turbulent—to introduce oxygen from the air, while the water in Acme can be recirculated to produce the same effect. The overflow goes into Bushkill Creek, which is a trout-fishing stream.

The oil reservoir is on the edge of Wind Gap and close to a heavily traveled highway, but it creates no community nuisance problems. As only vapor, not oil itself, causes odor, and as the roof on the pit curbs evaporation, little or no smell is noticeable. The protective roof and the relatively high "flash point" or ignition temperature of the oil likewise minimize the chance of fire. But for that matter, as the company pointed out, it would, should a fire occur, be hard to find a safer place to have it than in such a container.

Although new to America, underground storage of petroleum products has been practiced for fifteen years in Sweden primarily as a safeguard against possible bombing. Having no oil fields, Sweden must import all she needs. The usual practice there is to place tanks in openings hollowed out of the ground and made accessible through tunnels. Various shapes and types of vessels have been tried, ranging in content from 4000 to 8000 cubic meters (5200 to 10,400 cubic yards). The recent trend is towards 3000- to 6000-cubic-meter concrete-lined steel tanks of thin section fitted into a space so that the pressure of the stored liquid is transferred to the enclosing rock. These facilities are said to cost about twice as much as aboveground storage tanks, but the considerable reduction in evaporation tends to offset the difference in a few years.

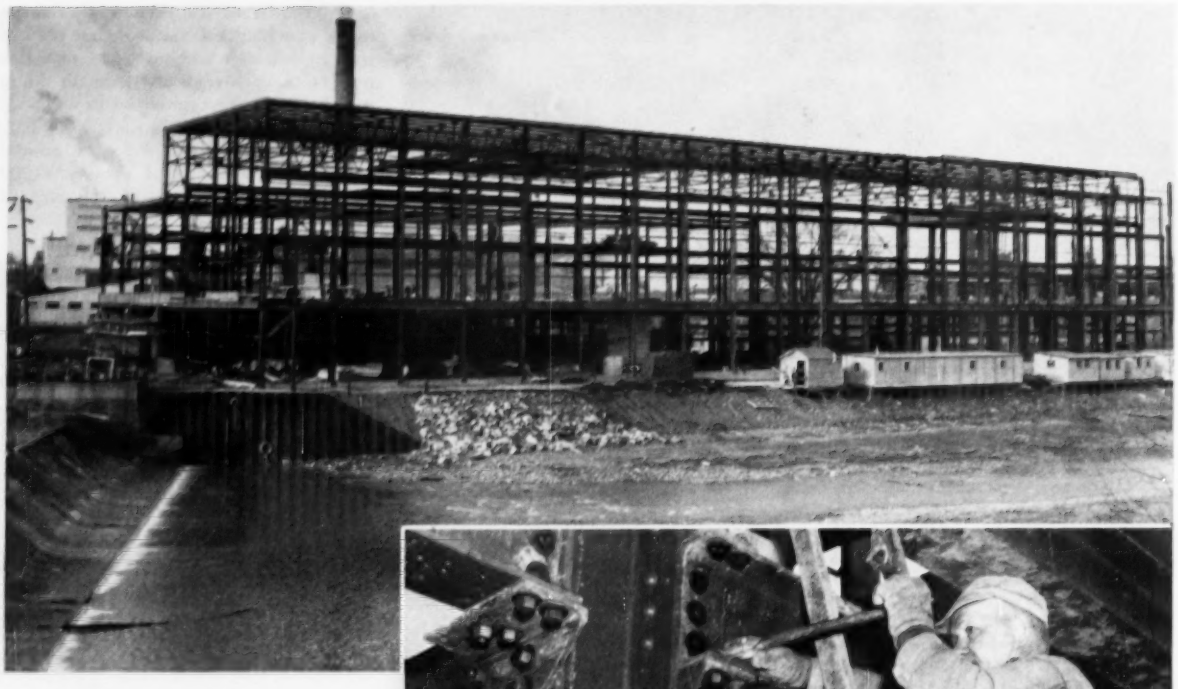
When Esso decided to try the Wind Gap experiment it took options on seven quarries in addition to the two now in use. It intends to put them in service as need arises, but it will most likely wait from three to five years to see if the first effort lives up to expectations. A company spokesman stated recently that the projected savings of quarry storage cannot be realized from only one unit, and added that the cost of the present one is about the same as that of conventional steel tanks of the same capacity.

Alpha and Acme represent an investment of $500,000, but this sum includes the cost of research and engineering that can be applied to the remaining facilities as they are added. Operating charges also will be less per unit if more quarries are placed in service. When all nine are ready it is planned, for instance, to use six for oil storage and only three as water reservoirs, with each of the latter doing double duty. The potential capacity of the six pits is estimated at 8,000,000 barrels, which is equivalent to the annual heating requirements of about 225,000 average homes, or a city the size of Washington, D. C.

The two converted quarries were purchased from Colonial Slate Company, which had not worked them for twenty years. Standard Oil Development Company, the central research and technical organization for the Standard Oil Company (New Jersey) affiliates, did the research and planning for the project. Construction, which began in 1953, was handled by Walter Kidde, of New York City. Hammond Iron Works, of Warren, Pa., designed and installed the roof. The storage facility is officially designated as Standard Oil Company Heating Oil Reservoir No. 1. It is operated by Tuscarora Pipe Line, Ltd., a Standard Oil subsidiary that primarily transports gasoline from the Atlantic Coast to the Pittsburgh area.

CONSTRUCTING ROOF

Placing the floating sectional steel-pontoon roof was aided by the fact that water in the quarry stood to within about 40 feet of the top. One of the standard rectangular pontoons is shown as it is about to be lowered from the bankside by a crane. The raised edges of the pontoons that are clipped together are visible.



STEELWORK AND IMPACTOOL

Steelwork for the 615-foot-long paper mill is shown together with a close view of a bolting team. The man at the left is using one of the new Ingersoll-Rand Torque-Control Impactools embodying a torsion bar that can be set to deliver the tightening effect wanted. The tool has a torque capacity of 550 foot-pounds. The second workman is holding a hand wrench on top of the bolt to keep it from turning.

Bolting Combats Paper-Mill Vibration

HIGH-TENSILE bolts were used recently to overcome vibration problems in a paper mill erected by Belmont Iron Works, of Philadelphia, for P. H. Glatfelter Company at Spring Grove, Pa.

A 2000-ton papermaking machine more than 430 feet long and located 20 feet above ground elevation subjects the building frame to dynamic loading from pulsating stresses, in addition to the static load of its own weight. Heavy overhead traveling cranes also increase the stresses on the steelwork. The largest crane, of the bridge type with a 50-foot span, has two hooks with a combined lifting capacity of 30 tons. Other equipment contributing to the vibration problem includes 10-ton and 5-ton paper refiners. The rolls in the calender stack serving the papermaking machine are 36 inches in diameter and weigh 30 tons.

To combat this accumulation of stress-producers, engineers from the J. E. Sirrine Company, of Greenville, S. C., investigated the bolting technique that has proved successful in ore unloaders and railroad bridges where similar stresses are encountered. On the recommendation of Russell, Burdsall & Ward Bolt & Nut Company, of Port Chester, N.Y., high-tensile-strength bolts were specified for all primary connections in joining the structural members.

Although bolts in the structural field are not new, the principle of high-tensile bolts is high clamping force that transfers the joint forces from plate to plate and from member to member by friction instead of by shear or bearing. By transferring the failure point from the net to the gross section, the bolts strengthen joints against fatigue, tension and other applied stresses. Equally important where changing loads are met, bolting eliminates the hole effect—where two loosely joined members slip against each other and set up shear stresses on the fastener.

The Glatfelter 3-floor plant is 615 feet long and has an average width of 100 feet and an average height of 60 feet. It contains 200 tons of steelwork and 8000 cubic yards of concrete. Outer walls are brick and aluminum siding, with horizontal separating panels of plastic to admit light. The general contractor was R. S. Noonan Inc., of York, Pa.

The 188-inch-wide machine can produce 14-foot widths of paper at a rate of 2000 feet a minute and 300 tons daily. Automatic equipment measures and blends various types of fibrous stocks, fillers and additives that are fed to the machine. As the paper comes off it is wound into 5-foot-diameter rolls, and finishing operations convert them into smaller rolls and sheets ready for the printer. Most of the stock will be used for books, tablets and envelopes.

Air-supported Buildings

HAVING proved successful in military outposts, air-supported buildings may be adopted for certain purposes in civil life. It will probably be a long time before anyone lives in one of them, but they apparently possess some inherent advantages for temporarily accommodating large gatherings, especially sports events, which call for big, unobstructed areas.

The frontiers of North America are already dotted with air-supported radomes housing radar antennas set up to detect possible enemy air attacks. Devoid of interior supports or framework of any kind and inflated with surprisingly low pressure, they have demonstrated their capacity to resist high winds and extreme temperatures.

Research on the subject was begun by Cornell Aeronautical Laboratory, Inc., of Cornell University under the direction of Walter W. Bird in 1946 when our Government started to develop the early-warning radar network. Exceptionally large antennas were needed to provide the radar range required. However, they had to be protected against wind and ice loads and, in order to obtain maximum radar transmission, the housing had to be constructed of a thin, nonmetallic material having a low dielectric constant. Uniform thickness was necessary so as not to distort the radar transmission pattern, and this ruled out the use of ribs or other stiffeners. Portability and light weight also were essential because the Air Force intended to transport the structures to remote areas by air.

The laboratory received a contract to make a full-size prototype for General Electric Company, which had been given the assignment of developing the complete radar installation. The first dome tested was 54 feet in diameter, 36 feet high and mounted on a 50-foot-diameter base at the Buffalo Airport. Only laboratory personnel knew what it was there for, and casual observers often asked when the balloon ascension was going to take place. The unit was built of single-ply neoprene-coated Fiberglas that weighed less than 2 pounds per square yard. Although inflated to a pressure of less than 1/10 psi it was unbelievably rigid.

Since that time more suitable materials have been produced. Among them is a 2-ply fabric that can be punctured with an 8-inch spear while under full design load without ripping further. Synthetic yarns have been made that provide coated materials having a strength-weight ratio equal to that of aluminum or structural steel. Some of them have shown good resistance to the effects of sunlight and weathering, which augurs well for keeping down dome maintenance costs.

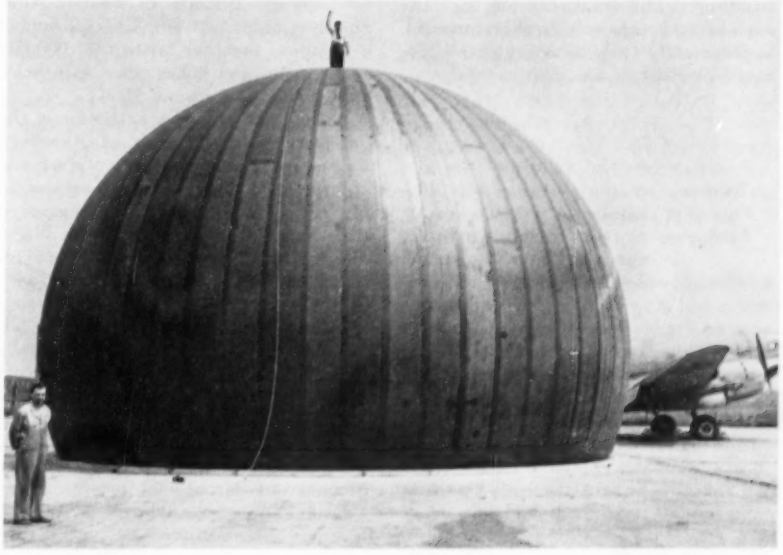
The air-supported radomes that are now standard equipment in most of the large ground installations in this country and Canada vary in diameter from 9 feet to more than 50 feet. So far structures of this type have served only the one purpose, but military minds are thinking about using them as portable hangars or shelters to protect personnel and equipment at remote or temporary bases and as gastight enclosures in the event of bacteriological or radiological warfare. Suggested applications in civilian life include temporary fair buildings, auditoriums, skating rinks and storage places for agricultural and industrial products. It is thought that they might also serve to roof over conventional walled structures for football and other sports events and warehouses. It would be easy to maintain the humidity inside at any point needed for certain processing operations, or to confine gases for the purpose of fumigating or preserving products.

At present, auditoriums and sports arenas that demand support-free spaces have heavy trusses to hold up the roofs and these, in turn, call for strong walls and foundations. A roof floating on air would reduce the load on walls and thus lower construction costs.

The pressure required to maintain rigidity is so low that it would be imperceptible to people; in fact the difference between inside and outside pressures would be less than that experienced in day-to-day variations of atmospheric pressure. Although simple air locks are provided as entrances and exits for most of the military air-supported structures now in use, it is believed that revolving doors would suffice to safeguard against loss of internal pressure even where large crowds are concerned.

Inflation would be taken care of by low-pressure blowers with two or more types of drive to make certain of continuous operation in case of power failure. A stoppage would not be as serious as might be supposed, however, because the air would escape so gradually through doors and other openings that the light fabric roof would settle slowly. In any event, there would be no danger of such a roof collapsing on the occupants in case of fire, earthquake or bomb attack. Because a thin fabric has little insulating value, buildings of this kind that are to be heated would have to be insulated. Several methods of doing this have already been proposed, and it is reported that they would not greatly increase the cost of construction.

The idea of supporting a roof with air pressure is not new. An Englishman named Lanchester suggested inflated balloon-cloth domes for service as field hospitals during World War I. Models of such a structure and of an exhibition hall were built on the same principle, but nothing more was done. In 1934 John H. MacMillan, Jr., of Cargill, Inc.,



TEST RADOME

This structure was erected for test and evaluation purposes on a concrete apron adjacent to Cornell Aeronautical Laboratory's hangar at the Buffalo, N.Y., airport. Many puzzled observers asked when the "balloon" ascension would take place. Although the inflation pressure was less than one-tenth psi, the walls remained rigid in high winds. Walter W. Bird, who directed the research, is shown standing on top of the dome.

Minneapolis, Minn., constructed a cylindrical 70,000-bushel grain elevator of sheet steel without interior supports after he had conducted experiments with a test cylinder, 8 feet in diameter, of the same material. The former was shaped like a cylinder split in half longitudinally and laid flat side down. It was 250 feet long, 50 feet wide and 25 feet high in the center. Although it was designed for a pressure of 70 pounds per square foot (about 8 ounces psi), there were so many leaks that it could not be held higher than 18 pounds per square foot. Nevertheless, the storage house proved to be structurally sound. It withstood heavy snowstorms and high winds. It was dismantled after a year of service, however, because grain dust remained suspended in the air and presented an explosion hazard.

In 1942 Herbert S. Stevens, a research engineer, proposed to erect buildings with roofs of flat metal sheets which, upon completion, were to be distended until they were dome-shaped. He designed a factory, 1200 feet in diameter, with a roof of sheet steel less than 1/20 inch thick. Later, Joseph A. Wise, who had been a consultant on the MacMillan elevator project, laid out a 300-foot-diameter circular structure. To obtain test data on the pressure that would be required to distend the roof and to support it afterward, Stevens and Wise conducted experiments with a 12-foot model at New York University, with the War Production Board as sponsor. A basic patent covering the roof was granted to Stevens in 1944.

In the following year a committee of 78 Baltimore citizens headed by Glenn L. Martin, the late airplane builder, did considerable work looking towards the erection of a sports stadium with an air-supported roof of sheet aluminum. It was to be 900 feet in diameter and have a seating capacity of 100,000. Stevens was the consulting engineer and made detailed plans, but the proposed structure was not built. In view of the recent successes with radar airdomes, interest in inflated buildings is apparently being revived. It is reported that Cornell University in Ithaca, N.Y., is considering the construction of a hockey rink based upon these principles.

This and That

Angling Device Copied

Industry is taking a leaf from the fisherman's notebook. The principle of the spinning reel has been adopted by Minneapolis-Honeywell Regulator Company for uncoiling wire. Wire used for winding components of electrical relays, transformers, motors, thermostats, etc., is now received in 100-pound coils in pail-like containers. Instead of being unwound from a revolving spool as in the past it is now pulled out of the open end of the pail. The firm uses around 2½ tons of wire daily and estimates that it will save $15,000 a year by reducing waste and eliminating spool handling. The empties bring 25 cents each in the company's surplus store and, appropriately, are in considerable demand by fishermen as bait carriers.

* * *

Illness Founded Business

In the middle of the preceding century Louis Bouloumié, a French lawyer, protested so vigorously against Louis Napoleon's seizure of power that he was exiled. Several years later he was permitted to return to France to visit well-known mineral springs for his health. Not being benefited, he tried a small spring at Vittel that was located in the Vosges Mountains and used only by the town's 1200 inhabitants. The water worked an almost miraculous cure, and on December 23, 1854, he bought the spring and the land around it for 3950 gold francs.

He established a resort-spa, built a hotel and bottling works and gave the water publicity. After he died in 1869 his two sons took over, discovered another spring and expanded the business. Today the spa, built around a park and providing facilities for sports, recreation and rest, attracts people from all parts of the globe. In addition, 317 million bottles of water of three kinds were sold last year and bottling facilities are being increased. Seventy percent of the bottles are of liter size (slightly more than a quart), and Vittel is called the world's largest-selling mineral water. The business is directed by Mme Germaine Bouloumié, a granddaughter of the founder.

* * *

Honor Aqueduct Builders

Pepperdine College in Los Angeles, Calif., was established in 1937 by George Pepperdine, founder of Western Auto Supply Company. He gave the school a campus, together with a $1,000,000 endowment, and it has since acquired a student body of around 1000.

Among the college's activities is the publication each month of *America's Builders*, a pamphlet history of some one of the nation's leading construction firms. Four years ago it also inaugurated America's Builders Recognition Night planned to honor construction people for their accomplishments. This year's gathering, held on June 1 and addressed by Ben Moreell, retired U.S. Navy admiral who now heads Jones & Laughlin Steel Corporation, paid homage to concerns and individuals that built the Colorado River Aqueduct—world's longest domestic water-supply line—from the Colorado River to Southern California. Singled out for special attention and awarded an honorary degree by the college was L.E. Dixon.

Born in Iowa, reared in Oklahoma and educated in Colorado, Dixon started at the bottom of the construction ladder and climbed until he headed his own company, meanwhile attending night school to get some formal engineering education. His firm and associates drove several of the Aqueduct tunnels and built two of the system's pumping plants. It has also constructed numerous schools, hospitals and hotels in California, as well as the Los Angeles Memorial Coliseum.

* * *

New Truck Compression Brake

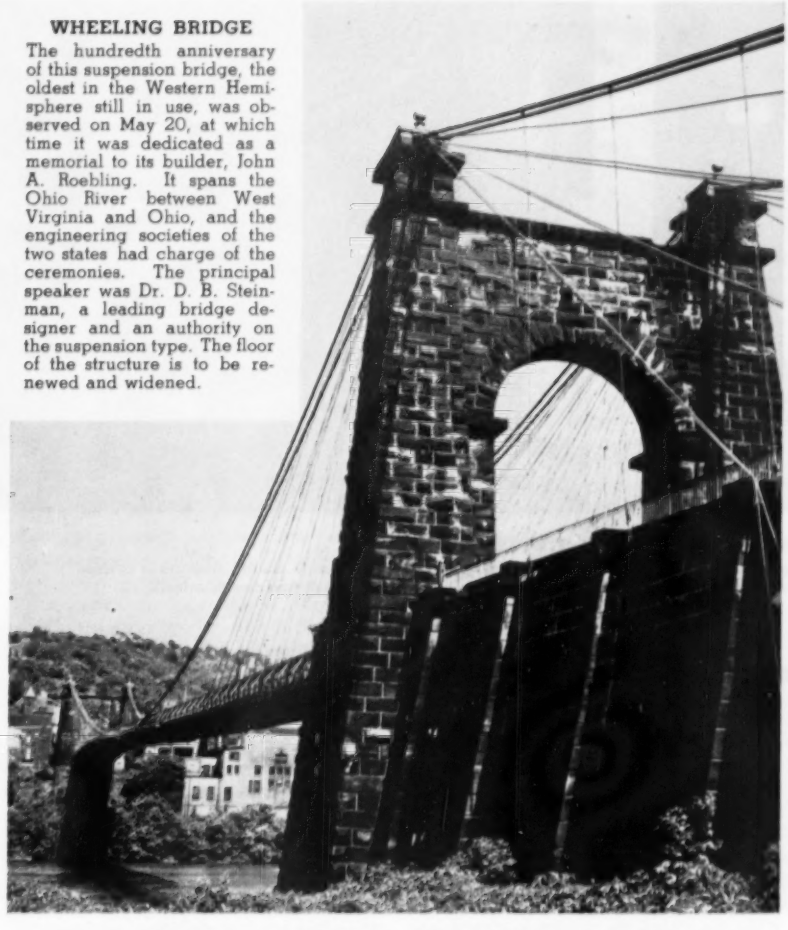
A powerful braking or retarding force may be exerted on a Mack truck simply by making its diesel engine serve as an air compressor whenever the accelerator is released and the brakes are applied. The conversion of engine to compressor is accomplished by an air cylinder-powered butterfly valve that is in the exhaust line and serves to trap air in the engine. The momentum of the truck is thus expended partially in turning the pistons through two compression strokes per revolution instead of one, as in a conventional diesel engine. A gain of nearly 50 percent in engine retarding power is the result, it is said, and it is expected to reduce brake-lining wear proportionately.

The butterfly valve is linked with the regular air-brake system and functions whenever the brake pedal is depressed, except that an overriding switch tied in with the fuel-injection system prevents the device from operating until fuel flow is completely halted. The idea is to prevent the retention of any fuel vapors or products of combustion—to insure that only air will be trapped.

The exhaust brake, as it is known, was introduced to this country in the late 1920's but failed to gain popularity. Recently, however, after it had met with considerable success in some European countries, Mack Trucks, Inc., came out with a new design that can be installed as optional equipment on its diesel-powered trucks.

WHEELING BRIDGE

The hundredth anniversary of this suspension bridge, the oldest in the Western Hemisphere still in use, was observed on May 20, at which time it was dedicated as a memorial to its builder, John A. Roebling. It spans the Ohio River between West Virginia and Ohio, and the engineering societies of the two states had charge of the ceremonies. The principal speaker was Dr. D. B. Steinman, a leading bridge designer and an authority on the suspension type. The floor of the structure is to be renewed and widened.



Bridges of Two Centuries

AN EVEN 100 years separates the two bridges pictured. The Wheeling Bridge across the Ohio River at Wheeling, W. Va., shown above, was finished in 1856. The structure across the Delaware illustrated below was opened to travel on May 25 of this year.

The Wheeling Bridge, still basically sound, is to undergo partial reconstruction later this year to increase its capacity. The original towers, cables and suspender cables will not be affected, but the floor will be replaced. Reflecting changes in the kind of traffic using it through the years, the roadway will be widened from 16½ to 20 feet and the sidewalks will be narrowed from 6 to 4½ feet. The work is estimated to cost around $500,000, which contrasts sharply with the $42,000 John A. Roebling received for the entire job a century ago.

The bridge across the Delaware joins the New Jersey and Pennsylvania turnpikes and was jointly financed and constructed by the respective state turnpike agencies. It will be a big timesaver and convenience for motorists traveling to and from the eastern seaboard. Now one can drive some 660 miles from New York City to the Ohio-Indiana boundary virtually without interruption and without meeting cross traffic on the same level. Such a trip, made entirely on pay highways, costs $8.60 in tolls, including 40 cents for the Delaware crossing and 50 cents for using one of the Hudson River tunnels when leaving New York.

The span, which contains 20,000 tons of structural steel and 55,000 cubic yards of concrete, is 6571 feet long and rests on 30 piers of which three are in the stream and four supported on steel piles. Its highest point is 270 feet above mean high water. The concrete deck is 76½ feet wide between curbs, with a 2-foot safety walk on each side. It has six vehicular lanes.

Additional construction was required in order to connect the two turnpikes with the bridge. Pennsylvania extended its system 33 miles from Valley Forge to the river's edge at a cost of $65 million. This link has been in operation since November 17, 1954. A connection slightly more than 5 miles long was built on the New Jersey side.

The bridge joins Edgely, Pa., and Florence, N. J., and is about 17 miles north of Philadelphia. Construction was begun on June 22, 1954, and completed in 23 months, one ahead of schedule. The substructure was built by Merritt-Chapman & Scott Corporation and the superstructure by American Bridge Company. The cost was approximately $14 million.

LATEST DELAWARE SPAN LINKS TWO TURNPIKES

The over-water continuous arch section consists of a 682-foot center span flanked on each side by a span of 341 feet. The fixed span over the shipping channel provides a clear width of 500 feet and a vertical clearance of 135 feet.

OLD AND NEW LIGHTING SYSTEMS COMPARED

Although of lesser wattage than the old globe-type incandescent units, the new fluorescent tubes and fixtures cast a stronger light on the pavement. Euclid Avenue is consequently more inviting after dark and much safer.

Downtown Cleveland Lights Up

AN EXPERIMENT in street lighting has just be a launched in Cleveland, Ohio. With its downtown area "losing out" after dark, better illumination was provided for Euclid Avenue, the principal thoroughfare, and civic leaders and merchants are already noting a gain in business. There is talk about extending the program to more of the district.

As accompanying pictures show, the street has been substantially brightened mainly by using more suitable equipment to better advantage. Fluorescent globes on 128 standards on both sides of the avenue cast more intense illumination where it is wanted than did former lamps and yet consume less electricity.

Each new fixture contains four 100-watt tubes that provide 21,400 lumens of light; each old one carried two 1000-watt globes that dispensed 40,000 lumens of which half was wasted. Each new fixture throws 1.67 foot-candles of light on the pavement, as compared with 0.7 foot-candles for the old. The latter required 1,024,000 kwhr of current a year; the present ones consume only 256,000 kwhr, and the charge for electricity will be $5000 less. When Euclid Avenue lighting was last improved in 1928 the property owners footed the bill. This time the city covers the cost, which has so far come to only $50,000.

The downtown sections of all American cities have a lot of competition these days. Once there was no other place to go for amusement after dark, but television, suburban shopping centers and night baseball have changed all that. Ninety-three percent of Cleveland's homes have TV sets. However, most people still like to go somewhere occasionally, but they no longer have to go downtown. Merchandising marts that have sprung up in outlying sections include movies, eating places and other entertainment facilities.

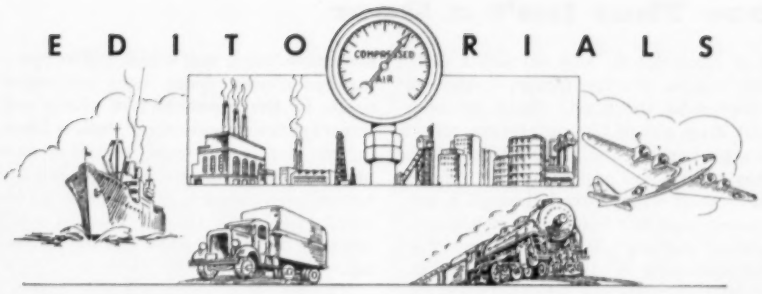
Before putting up the new lamps Cleveland took stock of what its downtown district meant in dollars and cents. It found that department stores do $200 million worth of business annually and restaurants $30.5 million. Six major hotels (3500 rooms) register 1.3 million guests, including 180,000 who attend conventions and spend $19.8 million. Ten "first-run" motion-picture houses there lure many persons at night. Once they were "islands of light," but that is no longer true.

Downtown means more than hotels, stores, restaurants and theaters in Cleveland. The Municipal Stadium, Public Hall and Music Hall are located there and drew close to 3,000,000 people to their various night events last year. Home games of the Cleveland Indians baseball team were seen by 1,221,000 of whom 570,000 attended after dark. The Metropolitan Opera attracted 50,000 to Public Hall; the automobile show 103,-000, a sportsman's show 109,000 and a circus 90,000. On the fringe of the business area is the Cleveland Arena where 600,000 saw ice-hockey contests and two shows on ice. The cost of replacing the downtown retail establishments, hotels and places of entertainment was estimated at $750 million.

Good illumination obviously helps to attract night shoppers. Monday has been shopping night in downtown Cleveland ever since the stores responded to the pleas of World War II husband-wife workers who were busy during the day. Transit-line riders into the center of the city are 10 to 12 percent over average on Monday night, and purchases of merchandise are heavier than on Saturday. The adage that business after dark follows light is borne out. People are more inclined to go downtown if streets are well illumined — it's pleasanter and safer. Women traditionally shun dimly lit places. Adequate lighting curbs night crime and also accidents. Pedestrians tend to ignore daytime regulations and precautions and cross streets in the middle of blocks where motorists sometimes do not see them in the semidarkness.

Clevelanders think it appropriate that they should be light-conscious. They recall that electric street lamps were introduced to the world in the public square that has been a focal point ever since it was laid out by Moses Cleveland's engineers in 1794. Charles F. Brush, one of the nation's first electrical wizards, there demonstrated his arc-light system of illumination on April 29, 1879. The lamps were rigged on top of 150-foot standards. Fearful that the burst of light might hurt their eyes, most of those who went downtown for the occasion carried smoked glasses. The next day one newspaper declared that "a dazzling glory filled the park." Until then, Cleveland's streets had been illuminated only by gas lamps which were not turned on when the moon was full.

EDITORIALS



IMPORTANCE OF SAVING

THE old adage that it takes money to make money applies to nations as well as individuals. By and large, the industrial growth of a country must be financed by the savings of its people. Industrial growth increases national income, and the higher the income the more opportunity to save. The process feeds upon itself as long as it can be kept from slowing down.

Backward nations—those that live mostly from agriculture rather than from manufacturing—do not generate sizable income surpluses. Their people are often on the borderline of famine, and if they do manage to get a little ahead, fear of the future often leads them to hoard their savings rather than to invest them. It is difficult for such countries to improve their general standard of living unless they get outside help.

Nations with valuable natural resources do not have much trouble attracting outside capital to develop them. Witness the vast flow of funds into the oil-rich Near East in recent years. If left to their own devices, it would probably have taken these countries half a century to attain the current output, which is the result not only of foreign money but also of foreign technical skill.

Backward nations which are not fortunate enough to have some natural resources that can be turned into ready cash must be given loans or grants if we are to have a healthy world economy with a sane political philosophy. At least, that is the way Uncle Sam and other leading western powers see it. In some of the Asiatic countries where most of the living comes from the soil only from 5 to 7 percent of the gross national return from production is available for investment, as compared with 16 to 17 percent in western Europe, Canada and the United States and around 14 percent in Latin America. The differences are even more pronounced when expressed in money rather than in percentages. In agrarian lands total income climbs very slowly and is often barely sufficient to keep ahead of the growth of population.

Aside from the sizable investments normally made by western European nations in their overseas colonies, most of the grants and credits in this category come from the United States or from the International Bank for Reconstruction and Development, which is largely financed in America. Last year's direct outlays by our Government totaled $2.2 billion. In addition, perhaps another billion of private capital left our shores to finance branch factories, to buy raw materials, etc. With the cold war between eastern and western ideologies continuing, students of world affairs predict that our Government will increase rather than reduce its allotments in coming years and will also stimulate private investments abroad.

Meanwhile, there has been a recent reversal here at home in the spending and saving trend. Prior to last year people had been putting aside around 8 percent of their income for a rainy day, but in 1955 they saved only 6½ percent. Federal Reserve Bank figures show that Americans are now buying a little less than they were, and as total consumer income has not dropped, more of it must be going into savings. Responsible for the change, economists think, are the rapid pace at which consumer wants were filled in 1955 and the current higher interest rates on installment buying.

NOTABLE ANNIVERSARY

THANKS to the Pure Food and Drug Law and the Meat Inspection Act, which were passed half a century ago last month, Americans buy food and drugs with confidence. Only those persons in the upper age brackets can remember that that was not the case before these protective measures were enacted. The maxim of the market place then was *caveat emptor*—"let the buyer beware." The oldsters also recall vividly the name of Dr. Harvey W. Wiley, fiery foe of filth, deception and fraud who spearheaded the cleanup campaign.

Before Doctor Wiley came along numerous efforts were made to improve conditions, but little was accomplished. From 1879 to 1906 more than 100 bills were introduced in Congress, but none with teeth in it was passed. Wiley, an Indiana-reared chemist who left a college teaching job to enter government service, became chief of the Bureau of Chemistry in the U.S. Department of Agriculture and fought without cease against food adulteration and other evils despite attempts to gag or smear him. He was firmly backed by President Theodore Roosevelt, who signed the bills that were enacted as a result of his efforts.

Prior to the Wiley crusade, labels on cans and bottles of food bore pictures of cupids, flowers and battleships, but they were rarely informative about the contents. Today, in contrast, approximately $60 billion worth of food, drugs and cosmetics shipped in interstate commerce are plainly marked and shoppers seldom have cause for suspicion.

Conditions are now so good that the Food and Drug Administration keeps tabs on 96,000 processing, manufacturing and warehousing establishments at an annual cost of only 3¼ cents per capita. The field staff is so small that it can inspect only about 10 percent of these facilities each year. As a result, it concentrates on the minority group described as the "fringe element of the industries that's trying to cut corners and make a fast dollar." Higher appropriations are in the offing, however, and the personnel will be increased.

The plan is to add more specialists in the physical sciences. It is important, for instance, to have technicians who can laboratory test the 700 or more chemical additives currently used in the food industry. It is reported that only about 40 percent of them have so far been thoroughly investigated. Also, when a bakery is found to be using insect-infested flour, it is essential to determine just when the infestation took place. If the insects were of the field variety rather than the storage type, the bakery would not be held accountable. Identifications of this kind naturally call for specially trained investigators.

Not all the progress made in safeguarding our food can be attributed to legislation. Better packaging has eliminated the insanitary cracker barrel and other open-air displays, and the new cellophane and plastic coverings permit shoppers to see what they are buying without subjecting produce to contamination. Even more significant are the advances made in refrigeration, pasteurization and transportation. Maine lobsters are no longer oddities in midwestern markets, and today people living along the north Atlantic seaboard can have fresh orange juice delivered with their morning milk that was squeezed in Florida not many hours before. The "good old days" in the food industry are right now.

In the realm of drugs, enforcement officers are hard pressed to keep up with the rapid developments. Hardly a month passes without the announcement of a new miracle preparation of some kind. It is imperative, of course, for the protection of the public that these be investigated and evaluated carefully and promptly. The nation's doctors and hospitals are of vast help in this work.

A Door That Isn't a Door

NOT long ago we made mention of an air curtain that serves a Cincinnati, Ohio, supermarket as a door during business hours. Since then we have obtained some facts about the Swiss application that might interest our readers. The installation consists essentially of airtight ducts which frame the doorway. The top horizontal section is divided into two longitudinal chambers connected by a small-diameter central opening for the passage of air to a series of adjustable nozzles of special design that extend the full width of the entrance. The air is supplied by a blower which, together with a filter, is mounted in the upper compartment.

Issuing from the nozzles, the downflowing air is drawn through a floor grating into the lower part of the closed system and then returns to the blower by way of the side ducts. But before it is recirculated, any entrained dust, dirt, insects, or other foreign matter are removed by the filter. Paper or solids that drop out of the air stream collect in a pit beneath the grating from which they are flushed periodically by numerous jets of water forced through a perforated pipe laid lengthwise in the bottom of the pit. With the comfort of the customers in mind, heating and refrigerating units are provided to warm the air in winter and cool it in summer.

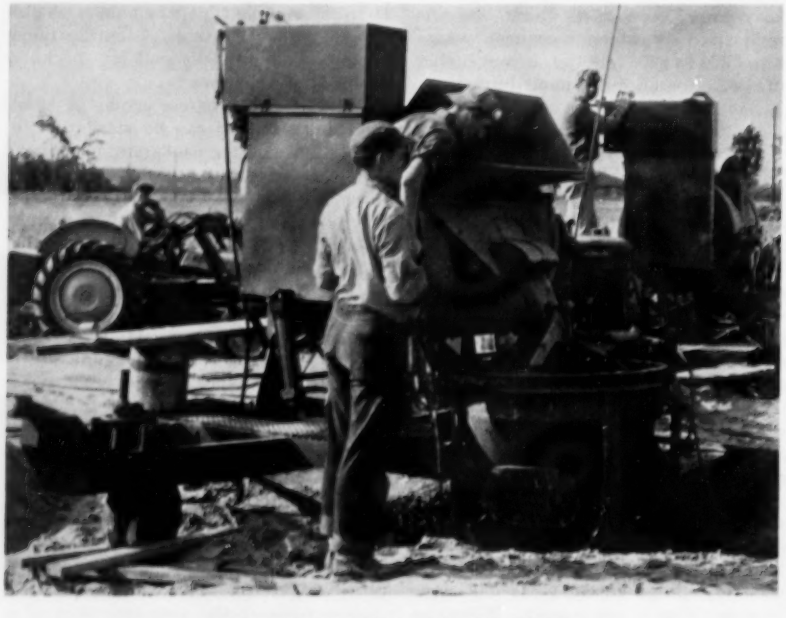
The "open door," it is argued, is an invitation to passersby to enter a store, while an unobstructed exit is, of course, a convenience to customers whose arms are full of bundles. The air current can be regulated manually or automatically to meet changing wind conditions and is said to meet requirements though it does not even ruffle the hair of a person passing through it. Furthermore, it acts like an insulating wall which, unlike opening and closing doors, does not create drafts to the discomfort of clerks and buyers at nearby counters. Besides keeping out debris and bugs, as well as cats and dogs which do not seem to like the breeze, any escaping air dries the pavement in front of the entrance in rainy weather and melts snow and ice in winter.

The biggest air curtain in use "covers" the 40-foot entrance of a store in Switzerland and is replaced by folding doors at the end of the business day. The one serving a Kroger supermarket in Cincinnati, the first in this country, is 11 feet wide. Another is planned for a store in the Grand Union chain in New York City. The minimum cost of installation in the case of a new structure is $500 a foot and the operating cost is estimated at from 15 to 25 cents an hour.

Process Produces Concrete of Variable Density

NOW available in this country is a special lightweight concrete of unusual properties. Made by the so-called Elastizell process, the material has been widely used in West Germany, where it was developed. With the exception of one special ingredient, it consists of ordinary cement and aggregate and is light because a large percentage of its volume is composed of air. In other words, the material is of cellular construction. The special chemical ingredient added is Elastizell, which is made up of a foaming agent and of a water-soluble plastic binder. When the chemical, cement and sand are combined in a special mechanical mixer—a high-speed unit equipped with blades of heavy wire mesh—the result is a homogeneous, aerated building material.

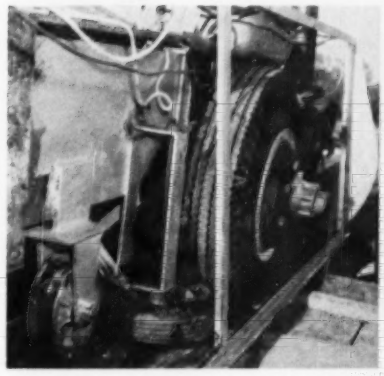
One of the advantages of the concrete is that its density can be closely controlled to produce anything from an extremely lightweight roofing material to a heavy structural type. This property is a function of mixing time and mixer speed, the paddles being rotated at from 50 to 55 revolutions per minute. If a dense concrete is wanted, the machine is set at low and the ingredients are mixed for only a short period; if a lighter product is desired, the speed is increased and the mixer is allowed to run for a greater length of time. Densities of as low as 30 pounds per cubic foot are possible. In addition, Elastizell concrete is highly resistant to moisture—it does not soak up water or other fluids like a sponge (its moisture absorption factor is said to be as low as 2 percent). It has a dry, warm-to-the-touch feel, rather than the somewhat chill feel of ordinary concrete, and is an excellent insulating material as well.



THE MIXER AND THE PRODUCT

The cellular structure of concrete made by the Elastizell process is shown at the right. The density of the lightweight mixture can be controlled closely. The material is also exceptionally resistant to water and is a good insulator. Special equipment (above) is required for mixing. In West Germany, where it was developed, the product has been used in laying more than 50 million square feet of flooring and roofing during the past five years.

Railway in The Sky



HOUSTON EXPERIMENT

With a stagecoach from a bygone era helping to accentuate its modernity, the Trailblazer coach (above) glides along underneath its single overhead rail. The close view (left) shows one of the eight upright traction and support tires and one of the twenty smaller guide tires housed in the coach's power nacelle.

A CAR that runs suspended from an overhead rail is being tried out in Houston, Tex. A pilot line 970 feet long, called the Skyway Monorail, is being operated in the city's Arrowhead Park by a group of Houston engineers and businessmen to determine its possibilities as a solution of some of our mass-transportation problems. Already it has been inspected by numerous transit authorities and city officials from near and far. The line is patterned after the suspended coach system that has long been used in Wuppertal, Germany. Known there as the *Schwebebahn*, meaning "floating line," it has carried more than 900 million passengers without a fatal accident during the past 53 years it has been in service.

The Houston experimental structure consists of a steel rail supported 18 feet aboveground by a series of inverted J-shaped towers 30 feet high. A single coach, 54 feet long and oval in cross section, is suspended from it. Eight Goodyear pneumatic tires carry the load and provide traction. Twenty other smaller tires, mounted in a horizontal plane, bear against the sides of the rail to guide the car and to keep it steady. It is said that there is virtually no noise or vibration in the carrier. The latter is powered by two 305-hp gasoline engines.

It is claimed that the monorail system is suitable for city transportation either above or below ground, or for interurban service. Cars accommodating 60 to 90 passengers can be run singly or in trains. The cost of construction is given as approximately $500,000 per mile, as compared with 4 to 6 million dollars for municipal freeways and 12 to 18 million for conventional subways. Monorail maintenance costs also are reported to be comparatively low.

Aluminum-Alloy Rivets Made for Hot Driving

ALUMINUM-ALLOY rivets of high strength for hot driving are in production after years of research work and testing by Aluminum Company of America. The new rivets are made of a special alloy—No. 7277—in sizes ranging from ½ to 1 inch in ⅛ inch increments and are supplied heat treated and quenched. They are designed for heavy-duty work on aluminum structures such as bridges, railway cars, cranes, etc., and for field work should be heated in a circulatory air furnace at a carefully controlled temperature from 850 to 975°F for about fifteen minutes.

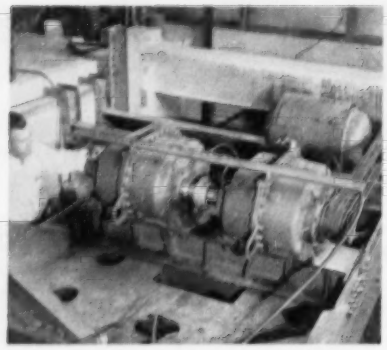
In reporting on the aluminum rivets, the company states that, size for size (excepting the ⅞- and 1-inch-diameter rivets, which require higher pressures), they are driven at pressures close to those commonly used in the case of steel rivets. The shape of the head has a bearing on these values—those with button heads, for example, call for four times as much pressure as those with cone-point heads. The shear strength of the No. 7277 is considerably higher than 3800 psi, the figure recommended as the ultimate on which design stress can be based. As to corrosion resistance, joints showed normal weathering and only mild attack after four years of exposure to the atmosphere along the Rhode Island seacoast and immersion in the saline tidewater off Miami, Fla., for two years. Because of their advantages, the new rivets are expected to have an important bearing on future structures composed entirely of aluminum.

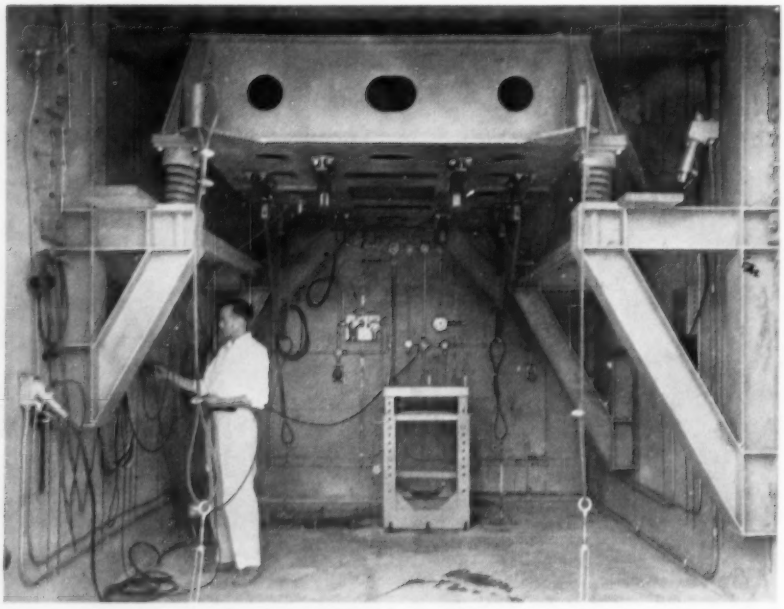
Improved Method of Charging Blast Furnaces

ACCORDING to press reports from Sweden, the Oxelösund Ironworks has been experimenting with a new charging system for blast furnaces that is said to eliminate some of the disadvantages of the method in common use. Ordinarily, no matter how evenly the charge of ore, sinter, limestone and coke is spread, the ascending gases seek the line of least resistance, usually along the walls of the shaft.

By the new system the charge is selectively and automatically distributed. Adjacent to the walls it may be either dense or of greater than normal thickness to check the flow of gas; elsewhere it is coarser or more permeable to facilitate its passage. As a result, there is little arching and the full volume of the shaft is effectively utilized. Findings after competitive tests conducted for more than a year in the plant indicate an increase of 15 percent in furnace capacity with a reduction in fuel consumption.

Vibration Unit to Study Shipping Damages





SHAKING IS ITS JOB

The purpose of this machine is to determine how air and rail shipments of apparatus may be best packaged to resist vibration damage. Equipment being tested is normally secured underneath the table with the aid of the racks shown. Two vibration generators (left) are mounted on top of the table.

A VIBRATION machine with a test-load capacity of 20,000 pounds has been constructed at the Boulder, Colo., laboratories of the National Bureau of Standards. The unit was built at the request of the Air Force to study the behavior of heavy apparatus during air and rail shipment. The vibration table can produce double amplitudes ranging from 0.020 to 0.065 inch at frequencies up to 60 cycles per second.

Millions of dollars are spent annually in repairing or replacing equipment that has been damaged or ruined in normal air or rail transit. Small, lightweight apparatus can usually be packed in well-padded crates to protect it from harmful shocks. However, it is generally much more difficult to safeguard large, heavy equipment in this fashion. As a result, the latter type is often shipped with no vibration protection or with inadequate built-in shock mounts. The NBS testing facility makes it possible to study the behavior of packages made up for transportation in a wide variety of ways.

The machine has two mechanical vibration generators, each of which can be given an unbalance of 50, 180 or 250 pound-inches. The two mechanisms with the same unbalance can be coupled together and driven as a unit, or they can be driven separately as required by the test procedure. They weigh approximately 500 pounds apiece and are powered by a 10-hp motor with variable speed control.

The generators can be mounted on top of the table for vertical motion or on the end for horizontal motion. Testing along the third axis is accomplished by rotating the package 90° in the horizontal plane with the shaker mechanism adjusted for horizontal motion of the table. The latter is 12 feet long and 6 feet wide, weighs approximately 11,000 pounds and is set on four coil springs that give the system a natural frequency of four cycles per second. Equipment to be tested can be suspended from the underside of the table.

Electric Power Hammer for Many Jobs

FOR maintenance and construction men who have to do endless demolition and other jobs such as drilling, riveting, chipping, descaling, routing, calking, etc., Ingersoll-Rand Company has developed a lightweight but powerful electric hammer built for ease of handling in any position. Weighing 12 pounds and 13 ounces, it incorporates an exclusive "spring-floated" piston that is said to deliver 2300 hard-hitting blows a minute and is accelerated by the sealed spring to intensify the blows. The design prevents leakage and loss of power such as sometimes occurs with air-cushioned pistons.

Other features embodied in the new tool are a counterbalanced crank assembly and helical gears for smooth and quiet operation; a neoprene-mounted nozzle that protects the hammer when accidentally run without a tool attached; and a heavy-duty switch controlled by a steel-bushed trigger and enclosed to keep out dust and dirt. The motor is cooled by a high-velocity fan. Known as the H54U Electric Power Hammer and rated for drilling up to 1⅛ inches, it is available in a standard kit (hammer with 15 feet of cable, ⅝-inch-diameter steel star drill, drill and grounding adapters, can of oil, tool retainer, dust shield and drift) with a choice of three packaged accessories including steel star drills and carbide drills of different sizes; moil-point demolition, mortar and bushing tools; as well as flat cold and wood chisels. The hammer can be used with equal facility on concrete, macadam, stone, cinder blocks, wood, metal, tile and earth.

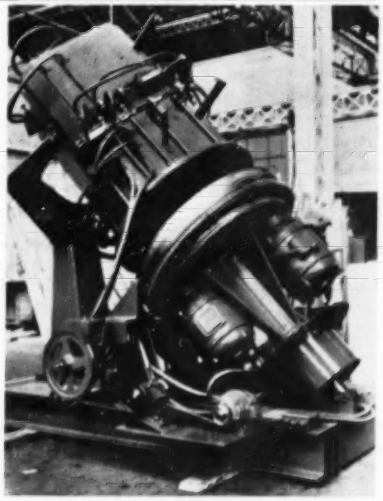
OVERHEAD JOB

Though the position is awkward, the removal of scaling from corroded metal is not hard work with an electric power hammer.

Circle 1E on reply card

Industrial Notes

Wood chips cut along the grain to preserve the natural fibers are being produced by a chipping machine developed by Guilliet, a French firm of wood-working machinery that has been in existence since 1847. The unit handles small wood, round timber, split logs, slabs, sawmill residue and other forms and is said to turn out uniform material of well-nigh any size and shape from fine wood flour to chips 2 inches long and 0.1 or more inch thick. Logs from 2 to 12 inches in diameter, for example, are fed into a canted hopper and brought by gravity in contact with special chipping tools, the wood being held the while by air-powered dogs. The downward movement of slabs, on the other hand, is controlled mechanically, while small wood is automatically bundled and held tight during the operation by pneumatic clamps within the hopper. Output varies with the raw material and the end product, a single unit reportedly turning out chips 2 inches long and 0.025 inch thick at as much as 6 tons per hour. The first Guilliet machine on the American Continent has been installed in the plant of a Canadian pulp and paper mill at Sault Ste. Marie, Ont.



GOLIATH WOOD CHIPPER
The machine is 10 feet high, 10½ feet long and 6 feet 7 inches wide and is powered by three electric motors. It is shown without the exhaust hood. The wood goes into the hopper without preparatory treatment, and the resultant material is ready for industrial uses.

Circle 2E on reply card

Under exclusive rights acquired from Switzerland, The Flexaust Company has begun the manufacture and sale of a line of bendable tubing that has found wide application in Europe and elsewhere since 1945. Known as Plica, it has a 3-ply wall and can be made in continuous lengths of almost any desired combination of ferrous and nonferrous metals, fiber, paper and other materials for use as electrical conduits; for lubricating, coolant and other noncorrosive-liquid lines; hot and cold air ducts; as a casing for shafts and many other purposes. It is claimed that the tubing has high wall strength, is watertight and can be stretched up to 5 percent of its length to compensate for error in measurement. It can be cut with a hacksaw or knife, bent by hand to sharp radii without flattening, re-formed and straightened without damage. Plica is now being produced by Flexaust in diameters (inside) ranging from ⅜ inch through 2 inches. It fits all standard connections.

Circle 3E on reply card

To reduce worker fatigue and to speed up operations in busy shipping departments handling large containers and odd-shaped packages, there is now available a pneumatic stretcher for ⅝- and ¾-inch tensional metal strap. The hand tool was designed by Brainard Steel Division of Sharon Steel Corporation and is available in two models weighing less than 7 pounds each: the PNKX with gripping dogs for flat-sided cases, and the PNK with a duck-bill head for round and irregular bundles such as pipes, tires, etc., and for application where space is limited. Using air at 20 to 80 psi pressure it is possible, it is claimed, to apply tension ranging from 660 to 1550 pounds with ease. With the strapping looped around a package, all the operator of the PNK (pictured) has to do is insert the free end through a seal and bend it back; slide the tool on the strap until the duck bill comes in contact with the seal; press down on the stretcher's actuating lever

The tiny ant has strength and stamina far out of proportion to its size . . .

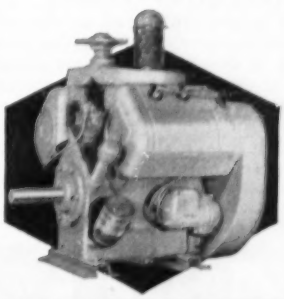
HEAVY-DUTY ENGINE POWER can be packed into small space, too . . .

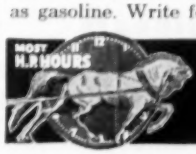
WISCONSIN HEAVY-DUTY Air-Cooled ENGINES

Like the tiny ant, Wisconsin scientifically engineered and constructed engines more than hold their own with power units of greater bulk . . . both in terms of usable horsepower and heavy-duty stamina.

The basic high torque design of these compact engines, combined with an accurate and sensitive governor, enables the engine to *pull through* when subjected to sudden heavy loads. It *hangs on* and *carries on!*

Wisconsin Heavy-Duty Air-Cooled Engines are available in twelve different sizes, in a complete power range from 3 to 36 hp. All models can be equipped with electric starter and generator (or starter only) and can be adapted to operation with kerosene, natural gas and LP fuels, as well as gasoline. Write for Bulletin S-188.





WISCONSIN MOTOR CORPORATION
World's Largest Builders of Heavy-Duty Air-Cooled Engines
MILWAUKEE 46, WISCONSIN

Circle 16A on reply card

to obtain the desired tension; make the seal secure and tilt the tool forward until the strap breaks. The Model PNKX works a little differently, but the results are the same—a package with straps that remain in place.

Circle 4E on reply card

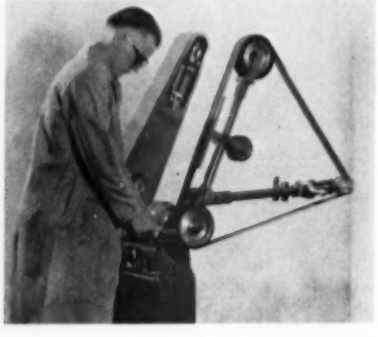
One of those simple things that make all the difference between slow and quick repairs has been introduced by Page Engineering Company. It's a Twin-Pin Connecting Link for heavy chains and needs only a hammer to do an effective job anywhere within five minutes, it is claimed. It consists of two identical, interlocking halves of high-manganese steel which are slipped through the ends of two lengths of chain and held together by driving two pins into place. The latter are oval so they cannot turn or slip, and thus prevent wear. Then a U-shaped key pin is inserted into the oval pins and the ends of the "U" are hammered or clinched together to form what is said to be a lasting link. The ingenious device can also be used to fasten the load line to the hitch-plate extension and as a trunnion-link connection. In that case only half of the Twin-Pin Link is required, as the illustration shows.

Circle 5E on reply card

Lightweight combined with strength and toughness are claimed for a new safety hat announced by Davis Emergency Equipment Company. It is constructed of ribbed alloyed aluminum to resist blows in excess of 40 foot-pounds, while snap-in shock-absorber suspension distributes and minimizes impact. Through the use of an adjustable cradle one hat fits all head sizes and shapes.

Circle 6E on reply card

One machine that is said to perform all basic types of abrasive-belt applications in grinding, polishing and deburring departments has been developed by Curtis Machine Corporation. Known as the Model DBA-1F Flex-A-Belt, the exten-



sion-arm assembly can be rotated a full 360° on the motor hub and permits using the machine for direct contact wheel grinding, formed contact wheel grinding on a contoured object, flat grinding by means of a platen and slack-belt polishing or deburring. With an interference-free idler contact roll even hard-to-get-at areas can be ground or polished. The accompanying illustration shows the unit doing direct contact wheel grinding with the aid of a work rest.

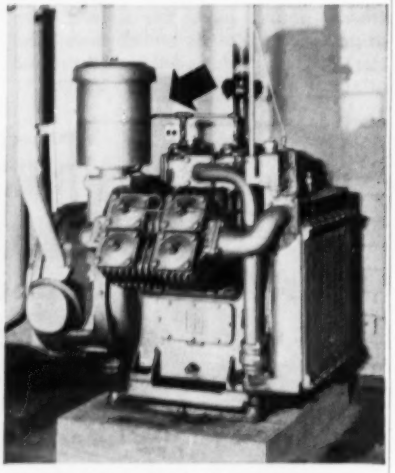
Circle 7E on reply card

Wm. W. Nugent & Company is offering a new full-flow lube-oil filter consisting of two units with a flanged switching valve between them. They may be operated independently or in parallel. Each has a capacity of 225 gpm of 150 SSU viscosity lubricating oil at about 5 psi pressure drop and is equipped with a 3-way cock, a differential pressure gauge and has a lifting mechanism to facilitate cover removal for recharging. The expendable cartridge is a laminated, crenulated fiber-disk model and is said to

Whether you build superhighways or inspect train brakes...

Air-Maze filters will keep your compressors on the go!

THESE COMPRESSORS supplied air for wagon drills used on the new New York Thruway at Suffern, New York. Working in dust and dirt, these compressors need clean intake air to prevent serious breakdowns. That's why they're equipped with Air-Maze oil bath filters. These filters scrub intake air clean in a bath of oil, reduce engine overhaul costs, cut maintenance costs and down-time.



AT NEW ORLEANS union passenger terminal, this compressor supplies air for inspecting brakes on trains, operating pneumatic tools, paint spraying and other repair and maintenance jobs. Its Air-Maze oil bath filter keeps air-borne dirt from damaging polished pistons, valves, rings and other vital compressor parts. Specify Air-Maze filters on the compressors *you* build or buy.

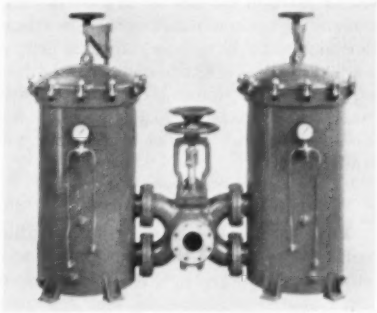
AIR-MAZE The Filter Engineers

AIR FILTERS • SILENCERS • SPARK ARRESTERS
LIQUID FILTERS • OIL SEPARATORS • GREASE FILTERS

25000 Miles Road • Cleveland 28, Ohio

Circle 17A on reply card

have a long service life. The duplex is an "extended-area" filter (actual filtering area is greater than the area of the



containers) that is said to combine high flow rate at low pressure drop with the fine filtering absorption and neutralizing properties of a depth-type filter.

Circle 8E on reply card

Rubber blankets or bags of virtually any contour for use in vacuum molding reinforced plastic laminates are being produced by a new process developed by the Quaker Rubber Division of H.K. Porter Company, Inc. Made of a special high-grade rubber, the bags are preformed by applying vacuum and cured at low temperatures right on customers' molds. The resultant product is said to hold its shape well, to have a long service life and to withstand temperatures up to 250°F. Tears can be repaired easily like those in innertubes. To insure perfect alignment, molds should be sent to the manufacturer; but when that is not practicable, as in the case of ships' hulls or other large parts, Quaker engineers do the work on the job.

Circle 9E on reply card

Sarco's thermodynamic steam trap that uses the kinetic energy of steam to close the valve is now available in ⅜-inch size, or four sizes up to 1 inch. Of stainless steel throughout, it has only three components—body, cap and valve disk—and one moving part, the solid valve head or disk. It is said to resist

water hammer; to operate equally well on light or heavy loads and against back pressure up to 50 percent of inlet pressure; and to close tight on no load. The trap is designed for pressures of 10-600 psi and temperatures to 950°F without changes and needs little if any maintenance. A trial installation is offered by the manufacturer.

Circle 10E on reply card

For chippers, welders and other workers requiring both head and eye protection, the Safety Division of The Boyer-Campbell Company has provided a cap with goggles of the cover-glass style that can be worn over personal spectacles. Named Supergard, the plastic headgear has a mounting bracket that permits the goggles, when once adjusted, to be raised and lowered as often as

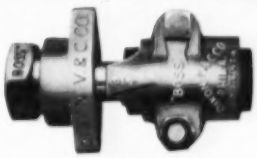
necessary without further attention. Headsize of the cap, which has a replaceable sweatband, is adjustable from 6½ to 8, and goggles are adjustable for pupillary distance, have individual cup action for perfect fit and may be worn slightly off the face.

Circle 11E on reply card

Boxcars used to carry foodstuffs in bulk or packages must be kept well lined to prevent rodent infestation, moisture penetration and loss through cracks. By a new method introduced by Archer-Daniels-Midland Company, the work can be done quickly and thoroughly. Whether making repairs or doing a whole relining job, a basic coat of resin is first sprayed on and then a Fiberglas reinforcing cloth is applied to the wet tacky film, the cloth serving also to cover holes or rough, splintered areas. This is followed by a second coat that dries in three or four hours to a hard, smooth finish. It is claimed that the lining is unaffected by temperatures from -30 up to 250°F and can be cleaned with detergents, disinfectants or steam.

Circle 12E on reply card

Demonstrations were made last month in some of our larger cities of a pint-size fire truck for inside use developed by Ansul Chemical Company to meet the needs of sprawling 1-story industrial



"GJ-BOSS"

GROUND JOINT AIR HAMMER COUPLING

The strongest and most efficient coupling for every type of air and pneumatic hose . . . and it requires no washer to keep it leakproof. Ground joint design provides a perfect soft-to-hard metal seal between end of stem and spud that is not affected by grit or dirt. Extra gripping power is assured by the superstrong "Boss" Clamp, with heavily reinforced extensions to engage collar on coupling stem. Compact Style, ½" and ¾". Heavy Style, ¾" and 1". Cadmium plated—rustproof.

"No. 3500" STEEL NIPPLE

A quality nipple that does a real coupling job inexpensively. Machined from cold drawn steel bar, with large-capacity bore and deeply corrugated, smoothly finished shanks. Collar back of hex portion engages extended anchoring fingers of "Boss" or "Air King" Clamps. Hose sizes from ¼" to 1", in various hose and I.P.T. size combinations. Cadmium plated—rustproof.

Stocked by Manufacturers and Distributors of Industrial Rubber Products

DIXON
Valve & Coupling Co.
GENERAL OFFICES & FACTORY—PHILADELPHIA 22, PA.
BRANCHES—CHICAGO · BIRMINGHAM · LOS ANGELES · HOUSTON
DIXON VALVE & COUPLING CO., LTD., TORONTO Associate Companies

Circle 18A on reply card

Have you seen what this CAN DO FOR YOU?

Torque control IMPACTOOL

NEW accuracy and speed for precision nut running jobs . . .

- **POSITIVE TORQUE CONTROL**—a revolutionary use of a rugged steel torsion bar for precision control of torque—combined with the power and speed of the Impactool.
- **SIMPLE TORQUE SETTING**—torsion bar adjusting sleeve is clearly calibrated for changing torque with easy-to-use torque jig.
- **TORQUE SETTING REMAINS CONSTANT**—for any nut running condition until the adjustment is changed.
- **ELIMINATES "OVER-TORQUE"**—impact mechanism rebounds instantly when preset torque is reached, tripping a foolproof rubber faced shutoff valve.
- **LOW MAINTENANCE**—combines many of the proven features of Ingersoll-Rand Impactools, with their enviable record of dependable performance and low maintenance.
- **REVERSIBLE**—full power in either direction.
- **NO CLUTCH**—to wear, slip or require adjustments.

* **2 TORSION BARS PROVIDE MULTIPLE TORQUE SETTINGS**

- No. L735 Max. torque 60 ft. lbs.
- No. H735 Max. torque 90 ft. lbs.

For torques up to 550 ft. lbs. a Size 5340T Torque Control Impactool is available.

Get a free demonstration of Ingersoll-Rand Torque Control Impactools by an I-R AIR engineer now... or write for additional information.

Ingersoll-Rand
11 Broadway, New York 4, N.Y.
8-342 **IMPACTOOL DIVISION**

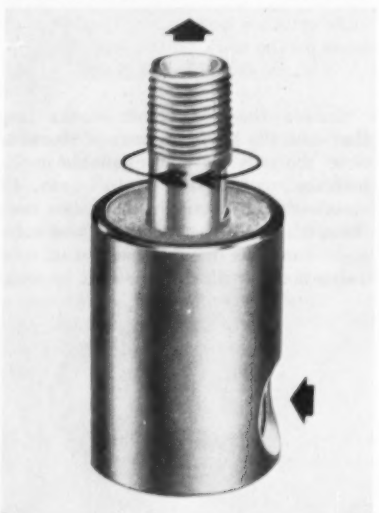
Circle 19A on reply card

plants situated in outlying districts beyond the protection of municipal fire departments. Only 5 feet 8 inches high, it can negotiate narrow aisles and use water, carbon dioxide or dry chemicals, depending upon requirements. The truck is designed to carry hose, ladders, utility bars, portable fire extinguishers and other equipment, all mounted on quick-release brackets. Space is also provided for boots, coats, air masks, a first-aid kit and blankets.

Circle 13E on reply card

Dust produced in roasting metallic sulphides at the Noranda Mines, Ltd., smelter at Noranda, Que., is recovered by Cottrell precipitators and returned to the furnaces at temperatures from 500 to 800°F by a special conveying system. The main feature of the latter is an Air Slide of porous aluminum oxide encased in a rectangular housing. As the dust accumulates it is pumped from a hopper into a mixing chamber where it is fluidized with compressed air. Next it is transferred by air at 15 psi through a line to a supply bin mounted above the roasters. From there it is fed to the Air Slide, where low-pressure air entering the lower compartment passes through the horizontal partition, thus again fluidizing the dust and allowing it to flow by gravity to the furnaces.

Introduction of a line of lightweight, small-size swivel joints for pneumatic and hydraulic services has been announced by Barco Manufacturing Company. Of the single-plane type, they are designed primarily to provide up to

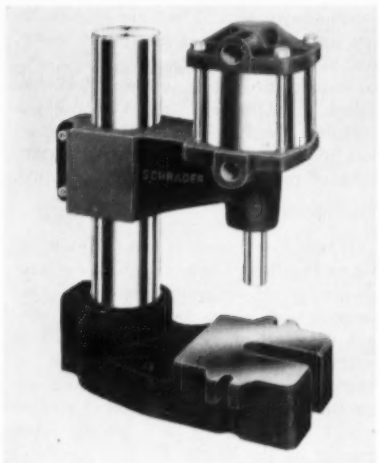


360° turning motion on machinery or other equipment requiring flexible piping, tubing or hose. They are being produced in ball- and thrust-bearing types for pressures as high as 2000 psi, depending on the size of the joint. Temperature ratings recommended range from –20° to 225°F. Units are available

in standard sizes of ¼ and ½ inch. The ¼-inch joint shown has an over-all length of 2¾ inches.

Circle 14E on reply card

Development of a powerful air press with a wide range of speed and performance possibilities has been announced by the Industrial Sales Division of A. Schrader's Son. The machine is of rugged construction with a heavy base and is built for 2-bolt clamping which permits of easy adjustment from 0 to 7 inches in height and a swing arc of 2



inches on each side of center. It is available in two models: single-acting for impact jobs and double-acting for squeeze and power withdrawals. According to the manufacturer, the new press can be used to perform numerous operations such as stamping, coining, broaching, riveting, staking, shaping, pressing, bending and assembling.

Circle 15E on reply card

Rope made of a long-staple ceramic fabric—an aluminum-silicate material called Fiberfrax—that is resistant to heat up to 2300°F has been announced by The Carborundum Company. The new product is said to be lightweight (30 feet of rope ½ inch in diameter weighs only one pound), resilient, chemically inert and unaffected by most furnace atmospheres, including hydrogen. It has many applications where heat is a factor, and is especially recommended as packing for expansion joints, wrapping for insulators, for use as gaskets and seals and for high-temperature calking. Fiberfrax ropes are available in three standard strand forms in coils.

Circle 16E on reply card

For use in conjunction with its power-operated centralized lubrication systems with time-clock control, Lincoln Engineering Company has developed injector spray-control valves that automatically apply a premeasured quantity of lubricant in mist form on closed bearings

AIRengineering at work

REPORT No. 5098B-3

Multiple Screw Driver assembles 400 carburetors per hour

Assembling carburetors was a slow, one-screw-at-a-time operation until AIR engineering solved the bottleneck. Now one operator uses this 8-spindle automatic Multiple Screw Driver to help turn out more than 6 completed carburetors per minute—400 every hour.

This compact, easy-to-operate Multiple Screw Driver is just one more example of how AIR engineering is helping modern industry solve problems and cut production time and costs.

All the experience of Ingersoll-Rand in speeding up fastening through AIR engineering multiple units is yours for the asking. Whether your operations involve screw-driving or nut running with either hand-held or automatic production line units, Ingersoll-Rand can engineer and build just the unit best suited to your needs.

8-Spindle Multiple Screw Driver for carburetor assembly.

Drop us a line if you'd like an AIR engineer to analyze and make recommendations on your fastening operations.

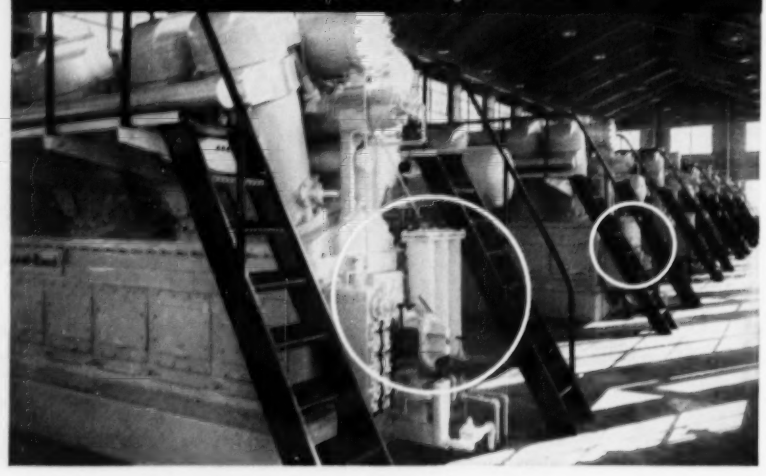
8-341

Ingersoll-Rand

11 Broadway, New York 4, N.Y.

Circle 20A on reply card

NUGENT FILTERS teamed with another leader to provide . . .



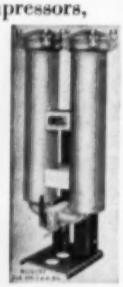
. . . TOP ENGINE EFFICIENCY

• Shown above is a view of six Ingersoll-Rand, 1320 h.p. gas engine compressors installed for service at United Gas Pipe Line Corporation's Needville (Tex.) station.

And here's top recommendation! All 6 powerful units feature the surest and most reliable filtration units available . . . NUGENT LUBE OIL FILTERS!

These mighty I-R units are used to boost gas to 900 PSIG discharge pressure on a new 30" line. Nugent Filters present the engine's first line of defense. They keep the lubricating systems free from harmful impurities because Nugent filter elements are designed to *catch practically everything*! By providing 20 times more filtering area than other filters of comparable size, Nugent Filters make possible greater filtering *action* and *more effective* filtration to insure longer engine life. Filters of the above type are easy to install . . . require no intricate piping . . . operate flawlessly and work perfectly in conjunction with any engine's overall lubricating system. They are available in full flow or by-pass with the same unit.

You can see low cost, dependable Nugent Filters on expensive machinery everywhere. Expensive machinery? We mean big or small diesel engines, gas engines, turbines, compressors, etc. On such equipment, manufacturers select and install, AS ORIGINAL EQUIPMENT, Nugent Filters. If you have a filtering problem, follow this advice—GET the surest, most effective filtration your dollars can buy. GET Nugent Filters for TOP engine performance. Write for full information.



Nugent Duplex Oil Filter. These filters are also available in Triplex Models.

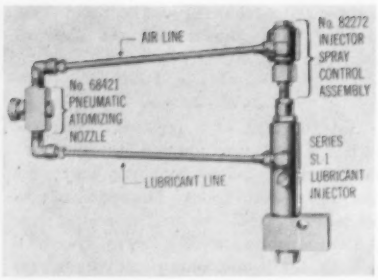
Wm. W. Nugent & Co., Inc.
3484 Cleveland St. SKOKIE, ILLINOIS

OIL FILTERS, OILING AND FILTERING SYSTEMS, TELESCOPIC OILERS, OILING DEVICES, SIGHT FEED VALVES, FLOW INDICATORS

Established 1897

Representatives in Boston • Cincinnati • Detroit • Houston • La Junta, Colo. • Los Angeles Minneapolis • New Orleans • New York • Philadelphia • Portland, Ore. • San Francisco Seattle • St. Louis • Tulsa • Representatives in Canada: Montreal • Toronto • Vancouver

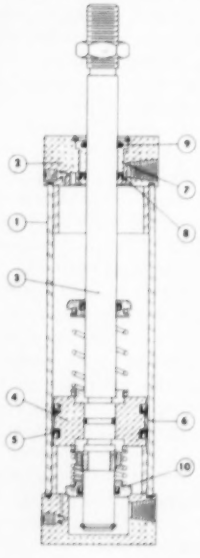
Circle 21A on reply card


AIR LINE
No. 82272 INJECTOR SPRAY CONTROL ASSEMBLY
No. 68421 PNEUMATIC ATOMIZING NOZZLE
SERIES SL 1 LUBRICANT INJECTOR
LUBRICANT LINE

and open surfaces such as gears, chains, cams, rollers, eccentrics, slides and ways, circular saws, etc. They are said to insure uniform lubrication without waste; to eliminate spoilage from dripping; and to reduce fire and accident hazards. Called MistOmatic Spray Control, the assembly also has been used on production lines to apply predetermined quantities of paint, glue and similar fluids.

Circle 17E on reply card

Of rustproof construction throughout, Alkon Products Corporation's new double-acting air cylinder possesses other features such as no metal-to-metal contact between cylinder wall and piston, positive cushioning with immediate acceleration of the return stroke and adjustable cushions for controlled strokes over 1 inch and up to 6 inches. Designated as the Model D, it is available in four bore sizes—1¼ to 3½ inches—with 3-way flush rabbet mountings and designed to operate with air under 250 psi pressure and water or oil under 500.



STRUCTURAL DETAILS

1, Seamless-steel cylinder barrel; 2, aluminum cylinder heads; 3, stainless-steel piston rod; 4, large-surface piston and heavy steel thrust ring; 5, piston packing; 6, nylon piston bearing; 7, Oilite cartridge-type piston-rod bearing; 8, piston-rod packing; 9, piston-rod wiper; 10, stainless-steel tie rods.

Circle 18E on reply card

BRIEFS

To discourage forgery, the W. A. Sheaffer Pen Company is mixing what it calls RC-35 to its regular Skrip inks. The additive is visible under ultraviolet light even after the original signature or writing has been eradicated.

•

One way of deflating the world if you have a mind to is to buy one of the new C. S. Hammond & Company globes that come folded. It stands 18 inches high and is expanded by lung power.

•

The process of vulcanizing rubber may soon undergo a decided change, judging by *Newsletter*, published by Industrial Research. It reports that the U.S. Air Force has vulcanized rubber experimentally by irradiating it with cobalt 60. Heat and sulphur were not used.

•

Uncle Sam owns a lot of real estate, according to a recent inventory. Aside from the 357 million acres in the public domain, he has purchased more than 50 million acres of which 1,700,000 is in the hands of the Atomic Energy Commission and 20 million represents airfields and military reservations.

•

For solid riding comfort truckers can get a seat with a Sky-Ride pneumatic base that is designed to prevent wearing and fatiguing bumps and jars. With it a driver can get any desired degree of cushioning by manipulating a 3-way valve. Air is taken from the vehicle's compressor or supplied by a hand pump.

•

Figures released by the Office of Defense Mobilization show that oil and gas pipelines now constitute one of the country's major transportation systems. Including the 17,000 miles of new mains in process of construction, the network will total 397,000 miles at the end of this year. In 1953, the last for which figures are available, our railroads had a mileage of 221,098.

"I thought we'd get this job done without the help of sidewalk superintendents!"

NO BED OF ROSES

Lines of Naylor lightweight pipe are your safest bet when it comes to carrying air, water or what-have-you over rocky terrain on construction jobs.

The reason why Naylor pipe can be laid on boulder-strewn slopes without fear of damage is the extra strength and safety inherent in its distinctive lockseamed, spiralwelded structure. Shock loads, stresses and strains don't phase it because this pipe structure is built to take punishment both inside and out.

Speed and ease of installation are other advantages of Naylor light-wall pipe to supplement the basic economy of its light weight.

For the entire story, write for Bulletin No. 507.

NAYLOR PIPE

Naylor Pipe Company • 1245 East 92nd Street, Chicago 19, Illinois

Eastern U.S. and Foreign Sales Office: 350 Madison Avenue, New York 17, New York

SPEED UP THESE TOUGH JOBS

Ingersoll-Rand GR-125 Gyro-Flo Compressor, Continental-powered, operating Mall chain saw cutting 12" x 12" timber to repair pier. Equipment in use on an eastern railroad.

WITH CONTINENTAL RED SEAL POWER

Year after year, ever since 1902, Continental engines have been proving their dependability in a steadily-lengthening list of special-purpose machines. Today, no matter what the exact requirement of the job, there's a Red Seal model—gasoline, Diesel, or LPG—engineered and built to meet it down to the last detail—a model with the proper performance characteristics, profile, shape and weight. In the industrial line there are models at closely-spaced levels—from 14 to 240 horsepower. You find them on an almost endless number of operations, speeding the tough jobs and delivering their full work quota, day in and day out, with a minimum of time out for adjustment or repairs.

SERVICE FACILITIES AND GENUINE RED SEAL PARTS AVAILABLE EVERYWHERE

® CONTINENTAL MOTORS · Powerful as the Nation · AMERICA'S STANDARD

Continental Motors Corporation

MUSKEGON • MICHIGAN

6 EAST 45TH ST., NEW YORK 17, NEW YORK • 3817 S. SANTA FE AVE., LOS ANGELES 58, CALIF.
6716 CEDAR SPRINGS ROAD, DALLAS 9, TEXAS • 1252 OAKLEIGH DRIVE, EAST POINT (ATLANTA) GA.

At the recent industrial fair held in Hanover, Germany, the firm of Salzgitter displayed an oil rig with two tubular legs containing necessary equipment such as ladders, conductors and piping.

•

Fifteen street cars taken out of service in Los Angeles have been shipped to Korea for use in Seoul and Pusan, and 60 more are scheduled to follow. Seoul's 2,000,000 people depend mainly on street cars to get around, and as there are only 135 of them long waits are the rule.

•

The electronics industry was founded in 1906 when Lee deForest developed the first 3-electrode vacuum tube, known as the audion. Progress during the intervening 50-year period will be recorded in 100 technical papers to be delivered at the twelfth annual National Electronics Conference meeting in Chicago, Ill., October 1-3.

•

German scientists at Heidelberg University are reported to have developed a "pneumatic arm" for amputees that is capable of a greater range of motions than any previously in use. It is powered by a motor run with carbon dioxide under pressure.

•

Since equipping two sizes of its earth-conveying scraper with tubeless pneumatic tires, Caterpillar Tractor Company has found that down time caused by tire trouble has been reduced 80 percent. Repairs, too, are simpler.

•

The soundness of castings has long been determined by the "ring test" by which a worker taps each one and listens to the sound pattern produced. But judging by ear has its drawbacks, so General Motors Corporation now depends on electronics and automatic rejection of defective work. By the new method the ring is picked up by a transducer and compared by an oscilloscope with the tone from a sound casting of the same size and shape.

"That new guy Smith is a trouble maker—always working."

Books and Industrial Literature

For use by foremen as a textbook for group training or to familiarize themselves with most of the general safety problems encountered in their work, National Safety Council, 425 N. Michigan Avenue, Chicago 11, Ill., has published the *Supervisors Safety Manual*. Of 354 well-illustrated pages, it was written by staff engineers of the Council's industrial department and reviewed by business, industry and government experts to insure a comprehensive guide on the subject. It contains data on first aid, protective equipment, machine guards, fire prevention, materials handling and power tools, tells how to maintain worker interest in accident prevention and enters into the human side of safety. Cost to Council members, $3.25; nonmembers $6.50.

Lunkenheimer Company's full line of air devices designed to prevent air leaks is illustrated and described in Circular No. 587 obtainable upon request.

Circle 19E on reply card

Uses and advantages of fiber conduit, an underground protective raceway for electric cables, is discussed in Catalogue No. 52 offered by Orangeburg Mfg Co., Inc.

Circle 20E on reply card

Fiberglas pipe insulation for hot or cold water and low-pressure steam lines in the temperature range of 50-250°F is illustrated and described in literature obtainable from Owens-Corning Fiberglas Corporation.

Circle 21E on reply card

Features of Link-Belt Company's self-aligning roller bearings are discussed in detail in Book No. 2658 available upon request. Data on how to select bearings and recommended fitting practices are included.

Circle 22E on reply card

Boltless steel shelving known as Klip-Bilt is the subject of Catalogue No. 706 released by The Frick-Gallagher Manufacturing Company. Of twelve pages, it shows the various open, closed and ledge-type shelving available and how to erect it.

Circle 23E on reply card

As a part of its Technical Studies Series, Allegheny Ludlum Steel Corporation is distributing a booklet on chromium-nickel-manganese austenitic stainless steels. Detailed charts and graphs are included in addition to data on the physical and other properties of the 200 Series, which contains less nickel than the 300 Series.

Circle 24E on reply card

Metal curtain-wall panels and 10- and 12-inch joists are among the new products listed in the 1956 Architectural Products Catalogue published by Stran-Steel Corporation, unit of National Steel Corporation. Insulated or noninsulated, the panels are applied by metal clips fastened by a clinching tool. Standard sections and methods of application are shown.

Circle 25E on reply card

Ingersoll-Rand Company has released a revised bulletin, Form 9143-B, covering its line of steam-jet water-cooling units ranging in size from 30 to 1200 tons of refrigeration. It contains a complete description of the component parts and auxiliaries, and diagrammatic illustrations in color show how a typical steam-jet cooler operates. A section covers automatic controls, including the Steam Sav-IR which is designed to re-

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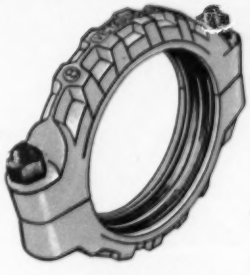

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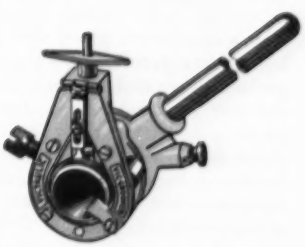

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Circle 24A on reply card

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Competitive Materials

Chart shows loss of thickness after alternating wet and dry exposure tests. Garlock 662 returns to within 1% of original thickness. No. 662, made from a cork paper base impregnated with a synthetic rubber, is dimensionally more stable than (A) beater process sheet with synthetic rubber binder, (B and C) sheets saturated with glue-glycerine binder.

GARLOCK 662 GASKET MATERIAL does not shrink or change shape

Here's convincing proof that gaskets of Garlock 662 can stand varying climatic conditions without drying, shrinking, or hardening. The gaskets illustrated were subjected to a 24 hour alternating wet and dry test for weeks, then conditioned at room temperature. As the photo and chart at right show, 662 gaskets returned to their original shape and to within 1% of their original thickness. Competitive types hardened, twisted, and shrank as much as 8%. No wonder so many companies are specifying 662 for use against gasoline, water, and oil at temperatures up to 300°F. It is approved by Underwriters' Laboratories, Inc. for use against hazardous liquids.

And longer-lasting 662 Gasket material is only one of "the Garlock 2,000" . . . two thousand styles of gaskets, packings, and seals to meet all your needs. It's the only complete line. It's one reason you get unbiased recommendations from your Garlock representative. Call him today or write for Bulletin AD-146.

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For Prompt Service, *contact one of our 30 sales offices and warehouses throughout the U. S. and Canada.*

GARLOCK

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Circle 25A on reply card

duce operating costs on installations that are subjected to varying condensing-water temperatures. The 24-page book should be of value to plants requiring chilled water for processing or air-conditioning applications.

Circle 26E on reply card

Dekoron instrument tubing, ranging from single to multiple lines in bundles or ribbons and from polyethylene to plastic-clad copper or aluminum, is fully described and pictured in Bulletin 456 offered by Dekoron Products Division of Samuel Moore & Co.

Circle 27E on reply card

General Electric mechanical-drive turbines operating at speeds up to 10,000 rpm and more are described in Bulletin GEA-6232, which also shows their design features in cutaways and schematic drawings. The units are built for high-speed compressors and blowers.

Circle 28E on reply card

The 1956 edition of the *Yearbook of Railroad Information* can now be obtained free of charge from the Eastern Railroad Presidents Conference. Of pocket size, its 100 pages contain the usual comparative statistics of the industry as a whole and give many facts about eastern lines as a group.

Circle 29E on reply card

Field Report No. 100 issued by The Rapids-Standard Company, Inc., deals with conveyorized workbenches built to flow work to and from operators engaged in assembling, inspecting, packaging, etc., so they are not required to move around. Different types of conveyors are arranged to meet service needs.

Circle 30E on reply card

Details of Fireye's smoke-density indicator system FE-3 are presented in Bulletin CM-22 published by Combustion Control Division, Electronics Corporation of America. Methods of operation and installation are shown, and three types of smoke recorders that may be used with the system are described.

Circle 31E on reply card

A 16-page bulletin, DH-486, intended primarily for plant executives, superintendents and supervisory personnel, is devoted mainly to Manley's (Manley Division, American Chain & Cable Company, Inc.) hydraulic- and air-powered presses of 25 to 150 tons capacity. Ten different models for varied applications are featured.

Circle 32E on reply card

A new release in Climax Molybdenum Company's Chemical Data Series is Bulletin Cdb-8 on refractory molybdenum borides that is available upon request. The data contained in the 6-page publication is wide in scope, running the gamut from chemical, physical and mechanical properties to the preparation and forming of molybdenum borides and multiboride systems. A source list of 25 references to molybdenum borides is appended.

Circle 33E on reply card

All-metal shock and vibration-control mountings for quieter operation of machine tools and industrial and business equipment generally are shown and described in Bulletin No. 1000 released by Robinson Aviation, Inc. Types, including Adjust-O-Mounts, vary, but in each case the load-carrying cushion, that is said not to drift, pack down or wear out with age, is made of Met-L-Flex —of stainless-steel wire. Load ranges of tested mounts are tabulated and recommended applications are listed.

Circle 34E on reply card

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WHIRL-A-WAY FILTER, REGULATOR AND LUBRICATOR ASSEMBLY and AUTOMATIC AIR TRAP

MODEL W-4

AIR TRAP

EJECTS WATER AUTOMATICALLY AND RAPIDLY

The FILTER removes solids .00039 and larger. Transparent bowl provides visibility. The REGULATOR can pass large volume with an unrestricted flow and minimum pressure drop. Self-bleeding, compact. Machined from bar aluminum.

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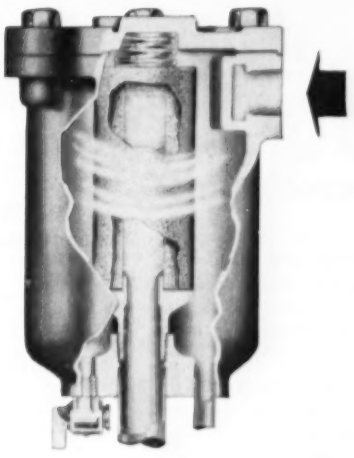

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You get protection that counts with Adams Poro-Stone Air Filters. Damaging water, rust contaminated oil, dust and pipe scale are removed from your compressed air . . . and there's virtually no pressure drop across the Adams filter.

Separation of foreign matter is in two stages — by centrifugal action from the movement of the air itself . . . by diffusion through the permanent Poro-Stone filter tube.

Not only do you save money in longer tool life and trouble-free operation, but also you save time. That's because Adams filters are quick to clean . . . have no moving parts to wear . . . need no special tools . . . proper assembly is all but fool-proof.

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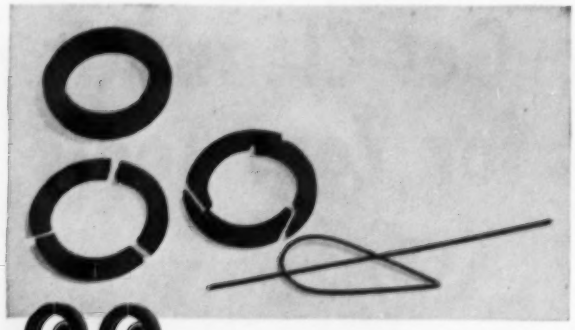

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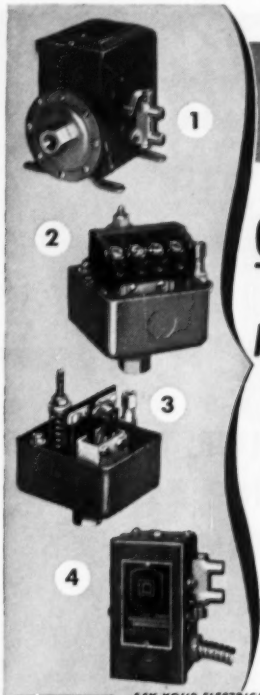

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Why not investigate the advantages our TOOL-OM-ETER or DRILL-OM-ETER can give you, both in cutting costs and in improving maintenance schedules?

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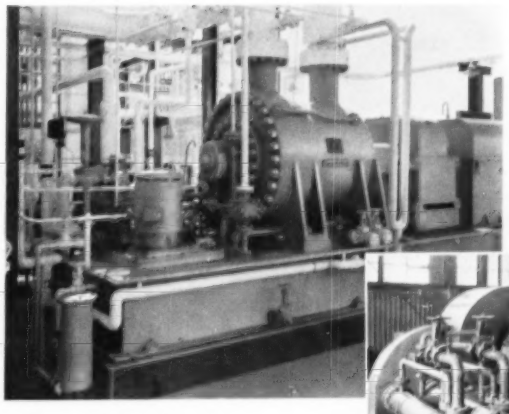
CENTRIFUGAL COMPRESSORS

cover practically all of your process requirements



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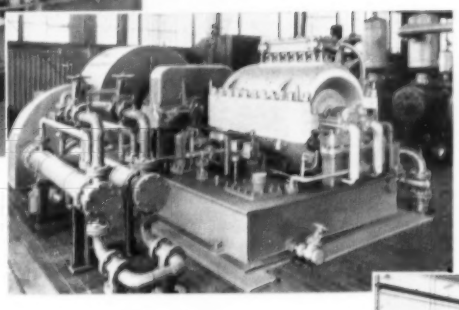

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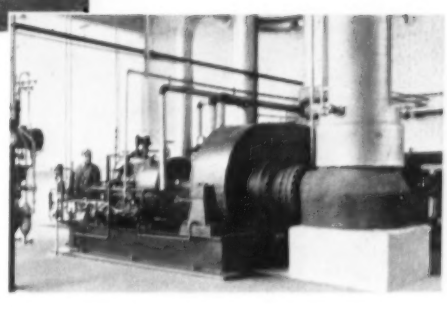

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Capacities to 255,000 cfm
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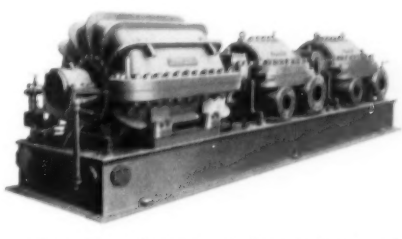

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Here are the three basic types of Ingersoll-Rand centrifugal air and gas compressors. The complete range of sizes available in each type provides extremely wide latitude to meet process conditions. By combining two or more individual units of the same or different types in tandem or in series, a great range of capacities and pressures are obtainable (units up to 2,000 psi have been furnished).

Any type of drive can be used and combination units can be individually powered or driven from a single source — electric motor, steam turbine or gas turbine. This flexibility of application is one reason why more and more I-R centrifugals are being installed in all types of process service.

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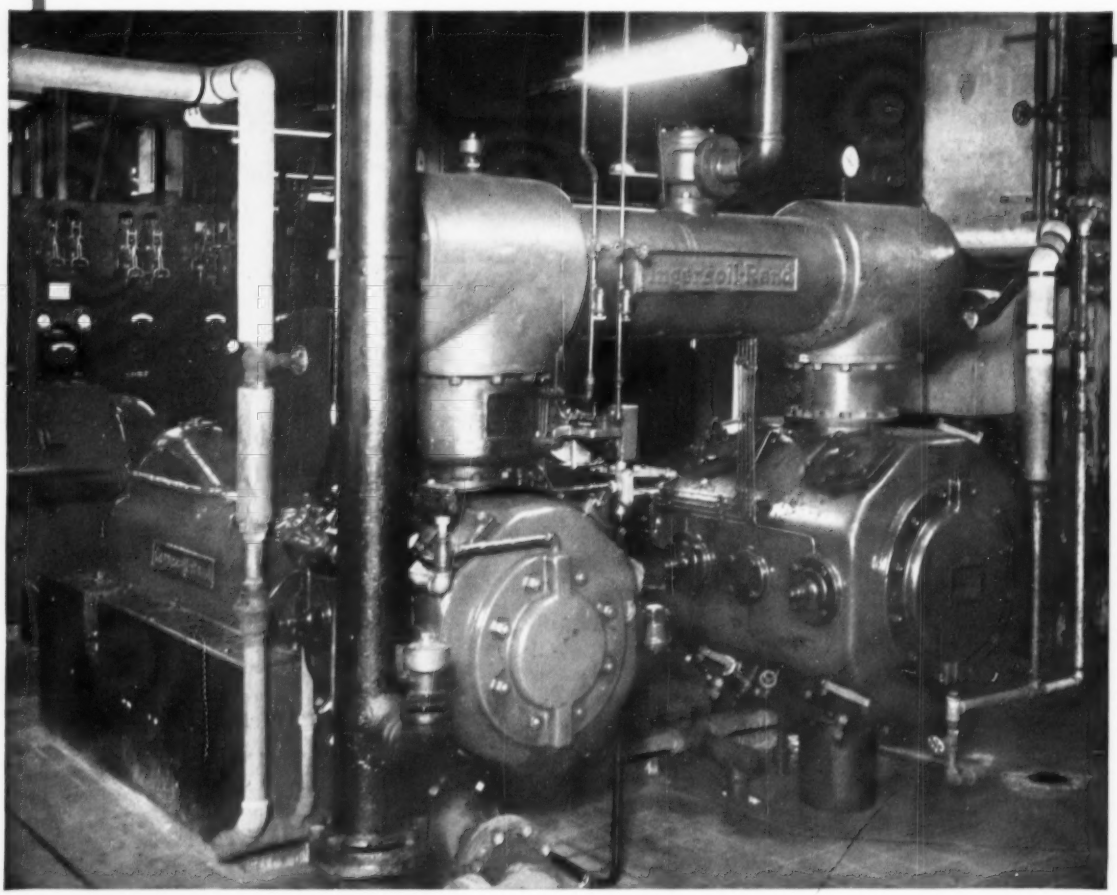

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